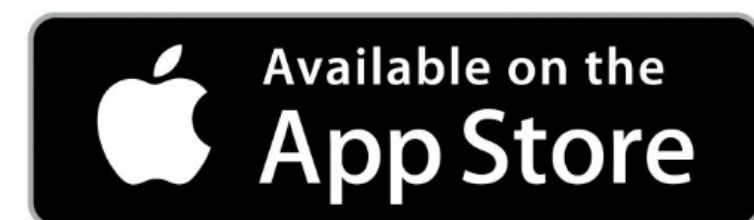# MentalFitness

:::::::::::::::::::::::

An AI-powered platform for digitalized mental health tests

Luca Hábel, Gábor Kőrösi, Csaba Potyók, Ákos Szőke

szoke.akos@multilogic.hu

27 November 2024

https://mental-fitness.hu

GET IT ON
Google Play

Available on the
App Store

Agenda

- Who we are

- MentalFitness Platform
  - Serious gaming platform

- Mental health tests
  - Memory screening – for self screening
  - MMSE – screening for cognitive impairment
  - ACE test – comprehensive cognitive assessment
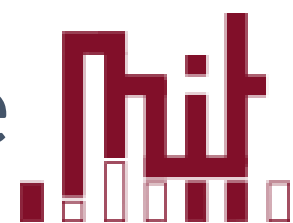
MentalFitness Consortium and References

Multilogic Ltd. (foundation: 1986. 30+ people)

Software development and consultation

BME MIT department

Department of Artificial Intelligence and Systems Engineering

Semmelweis University

Department of Psychiatry and Psychotherapy

Major joint projects in consortia

- **FRONT-VL** Improving quality of life with services at home (2018-2019)

- **iCare4NextG** - Virtual community space to support quality of life for older people (2021-2022)

- **Bp. Hegyvidéki Önkormányzat** Memory screening (2023)

- **SymptoMind (SEPPK)** – Monitoring the condition of schizophrenic patients (2024)

- **Testnevelési Egyetem** Mental performance measurement (2024) IN PROGRESS

- **Velence Önkormányzat** Memory screening (2024) IN PROGRESS

- **II. kerületi Önkormányzat** Memory screening (2024) IN PROGRESS

Multilogic - important references

MentalFitness: An ecosystem supporting preventive, curative and care systems for mental health

- **Challenges**
  - Dementia detection, early diagnosis, initiation of the disease pathway
  - Depression detection, early diagnosis, initiation of the disease pathway
  - Schizophrenia status monitoring, intervention over time
- **Actors**
  - Patients, Family/Friends, Social services, Healthcare institutions
- **Goal**
  - Safety net, personalised lifestyle advice, improving quality of life
  - Develop a personalised integrated solution (social, medical) based on local experience
    - Self-care assistance (gamification tests, physiological parameters, sensors in home environment)
    - Care and follow-up (family members, social and health institutions)
    - Treatment support (health institutions)
- **Expected outcome**
  - Closer cooperation between Patients - Family/Friends - Social and Healthcare institutions
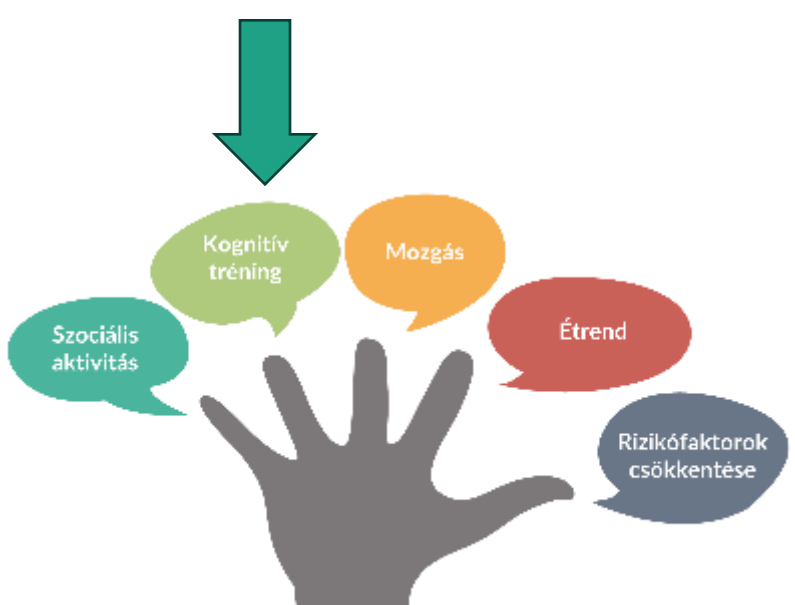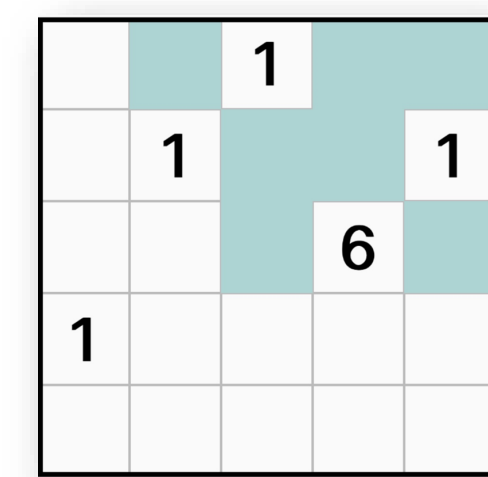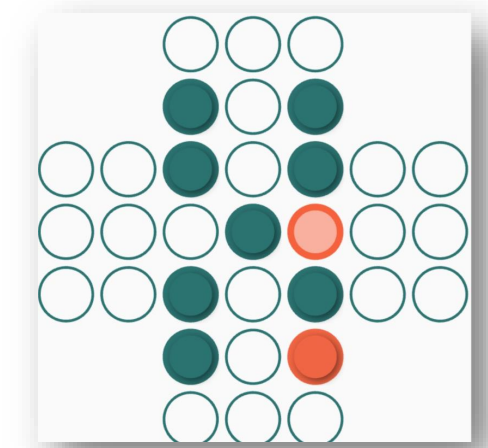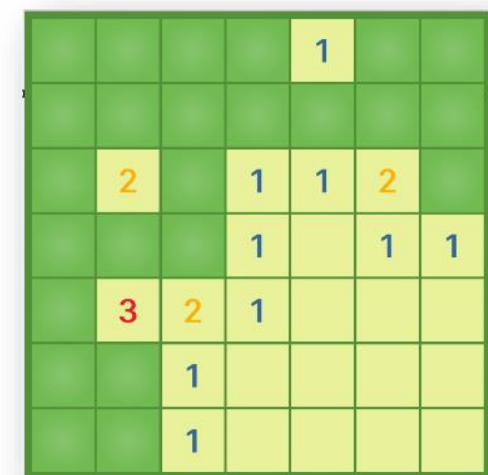 - Early and more effective symptom recognition, monitoring and faster intervention

MentalFitness, as serious game platform

Training all brain functions is essential for mental wellness

executive function

reaction time

attention

learning ability

spatial-visual working memory

planning ability

verbal working memory

Source: Dr. Farkas, Kinga, adj., (Semmelweis Univ. Department of Psychiatry and Psychotherapy)
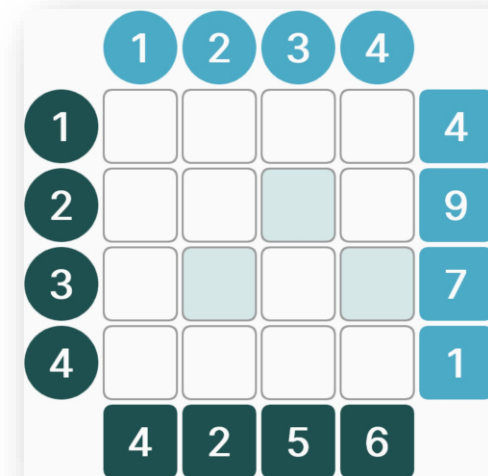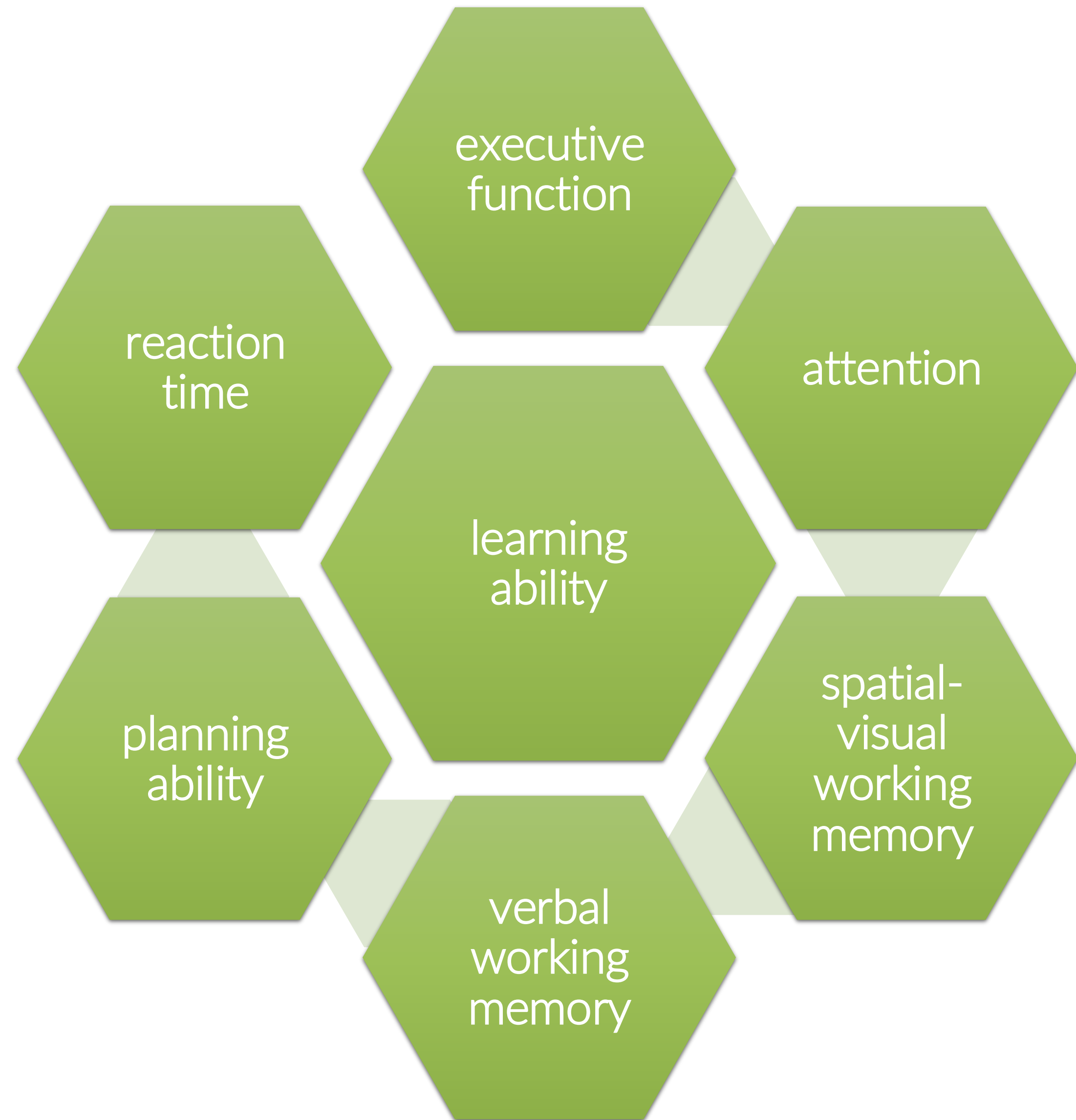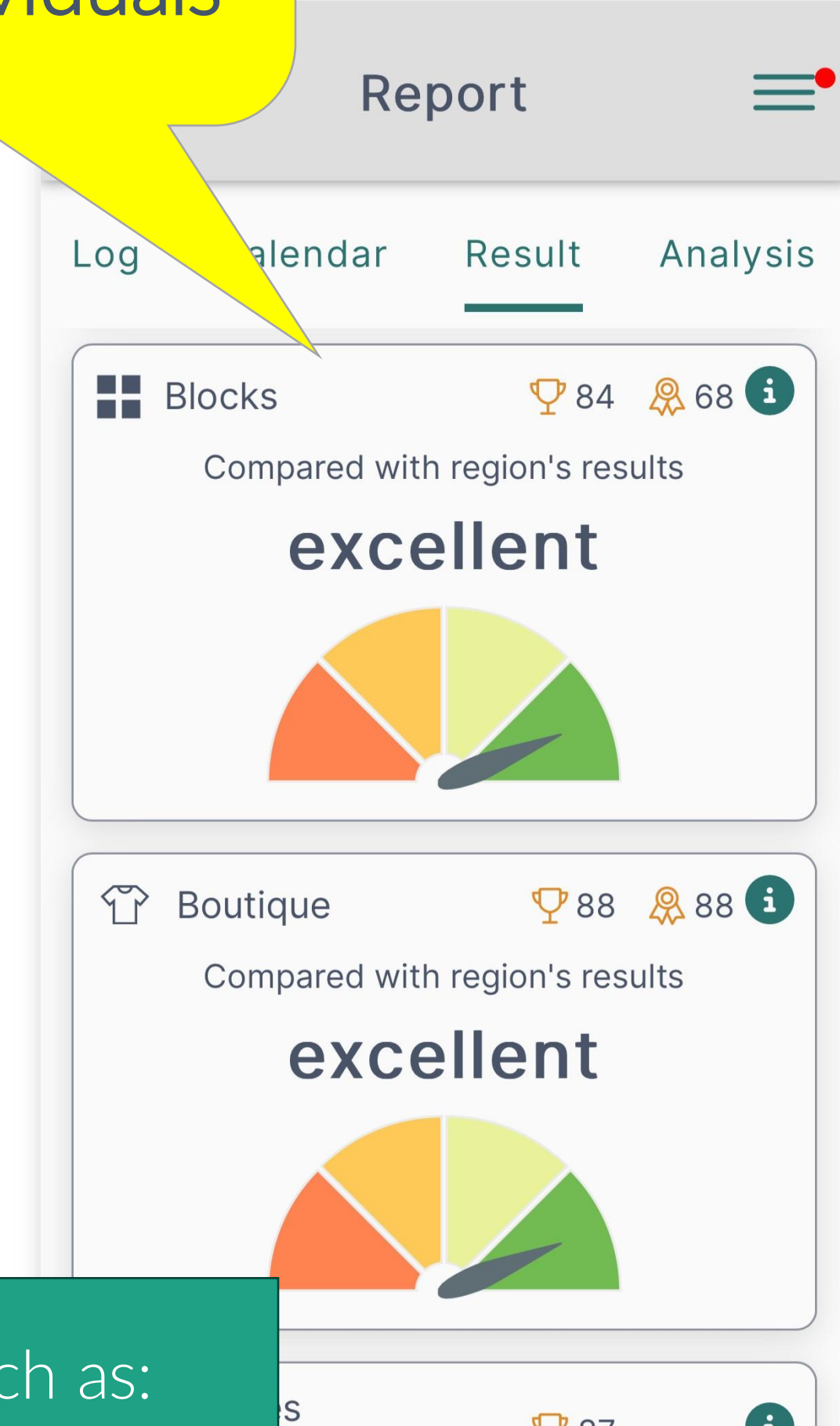
Serious games – sample screens

Available serious games (~30)

2048, Mill, Boutique, Gophers, Sudoku, Tic Tac Toe, Swap Puzzle, Nurikabe, Ka... ...oing, Blocks, Syno anto, Labyrinth, Dobble solo, Word Creator, Minesweeper, Letters, Peg solitai... ...lock puzzle

Statistical results: compared to the similar individuals
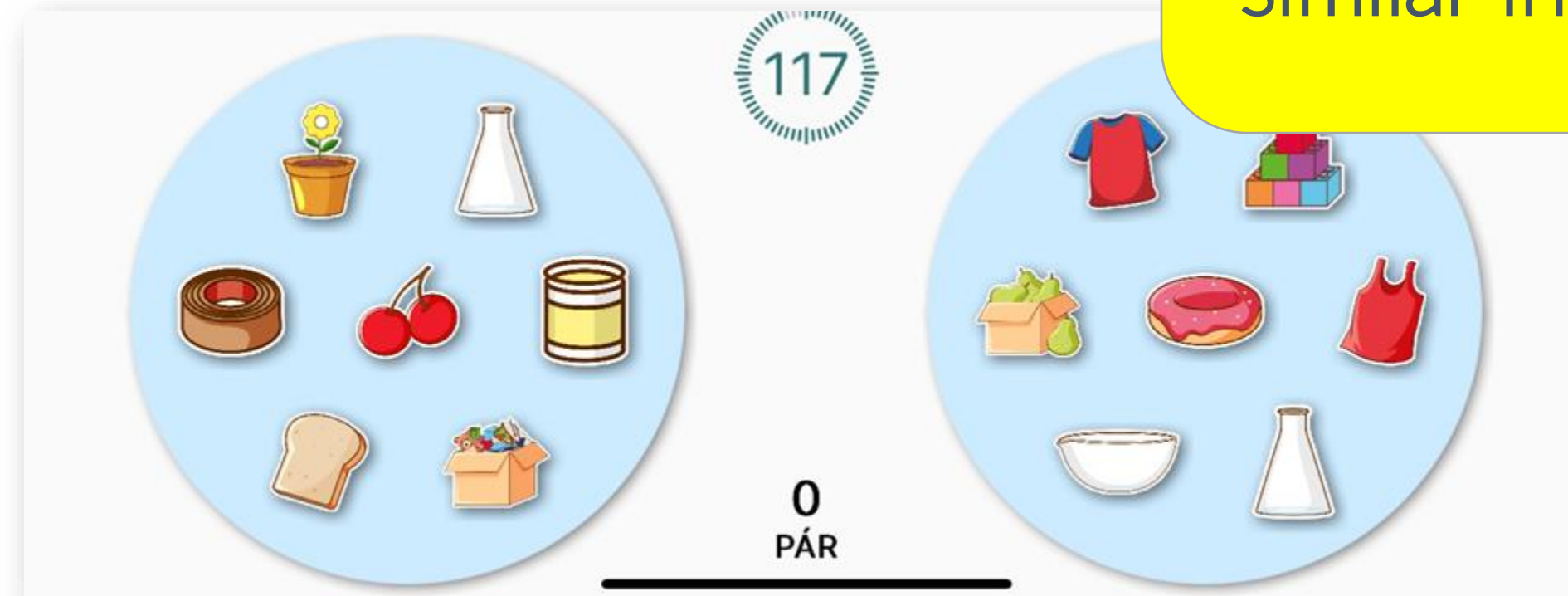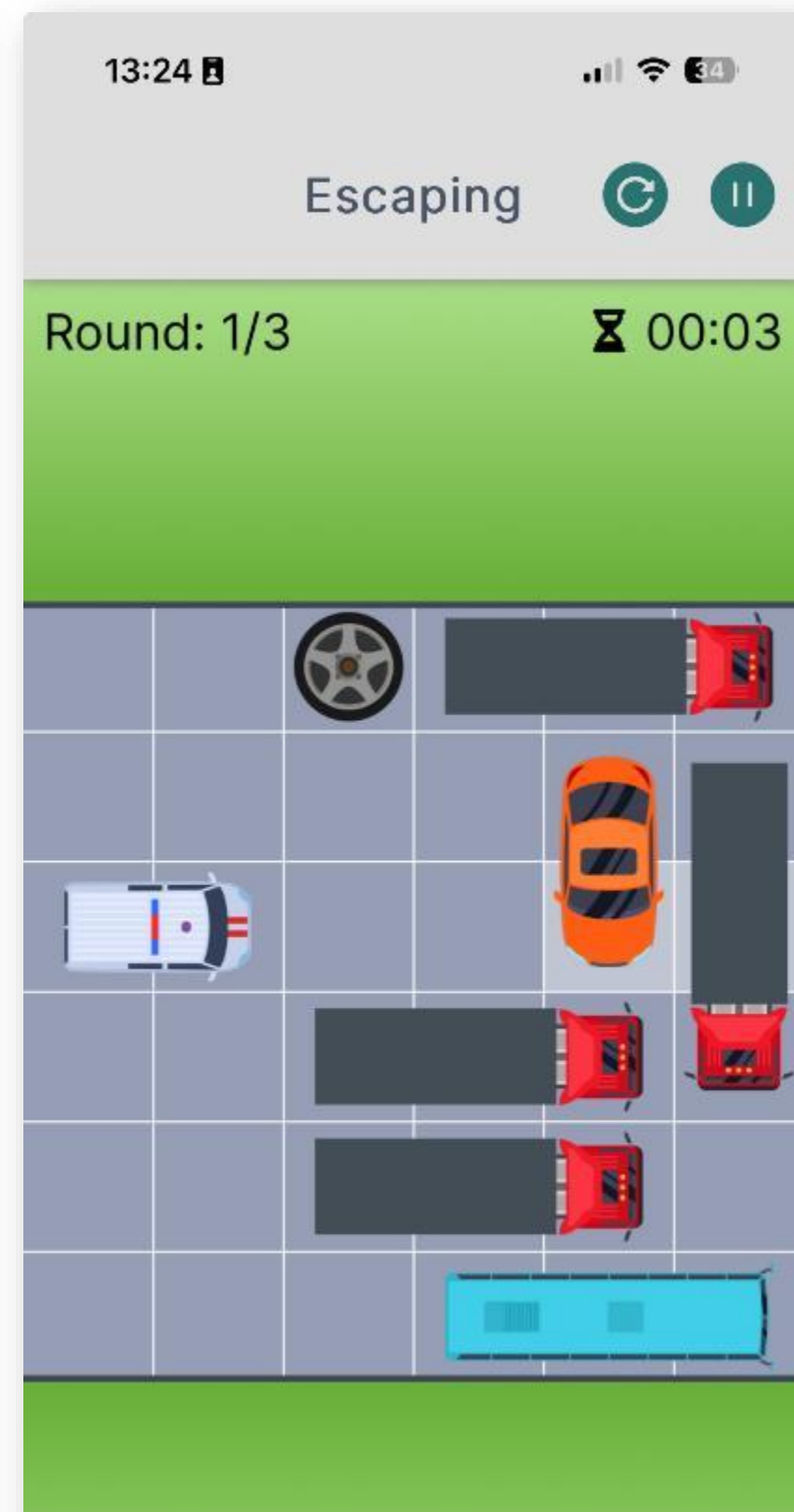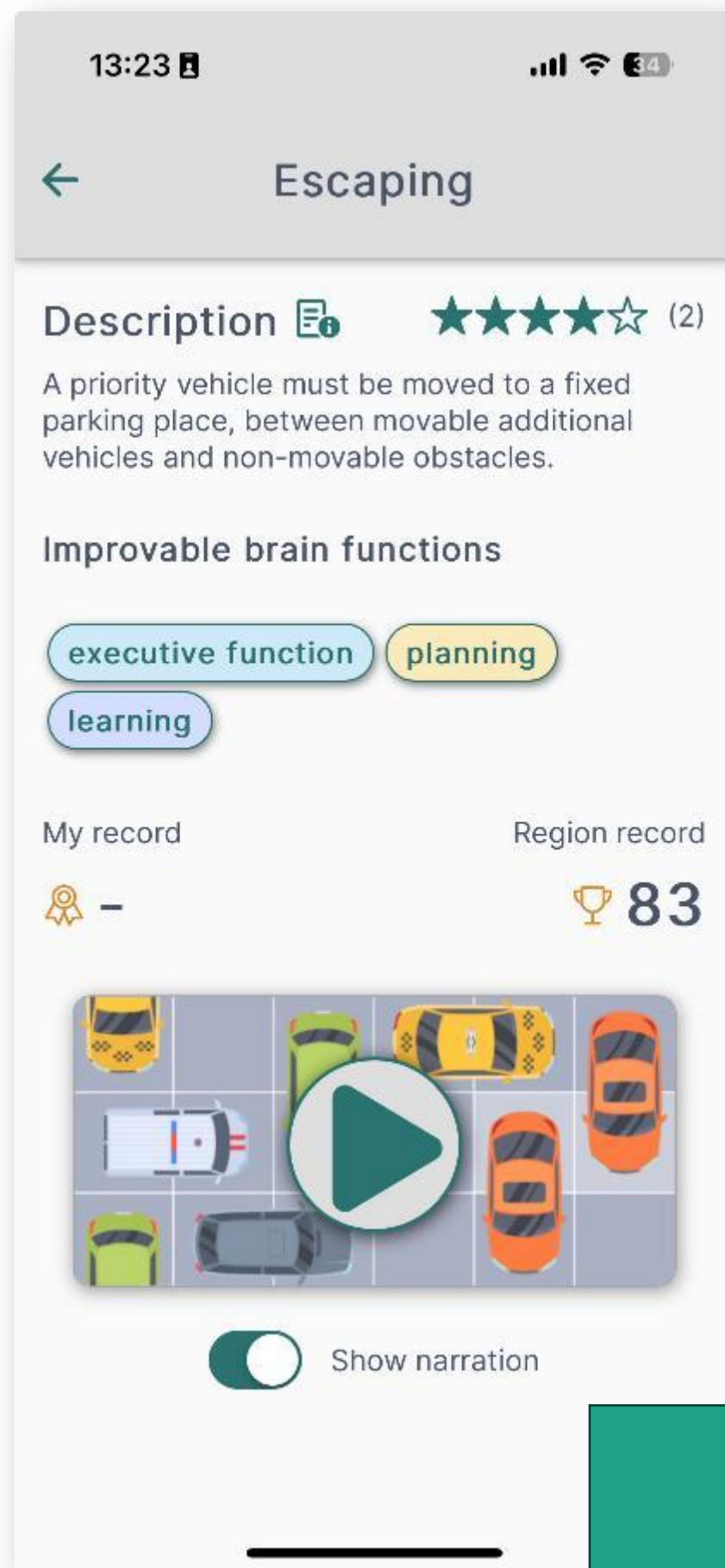
Dobble solo
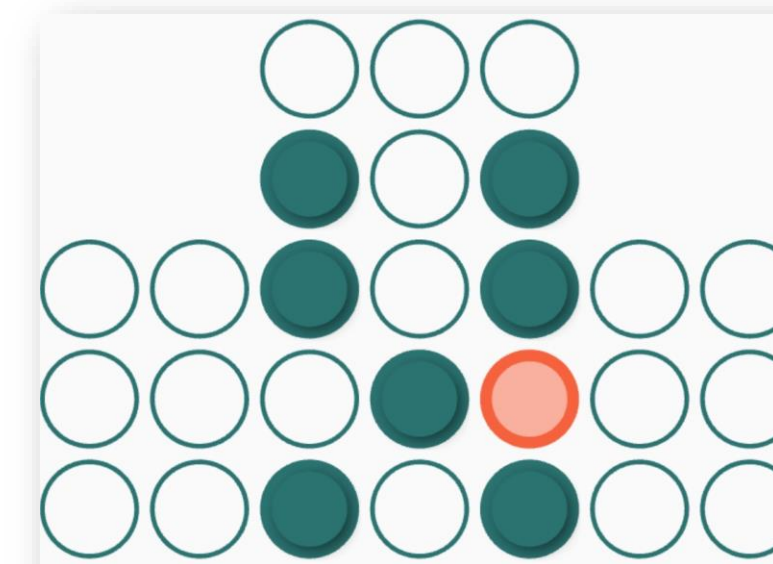
Additional clinical tests are available (for Healthcase institutions) in the platform such as:
Trail making, Corsi, Wisconsin, Luggages, Stranger etc.

MentalFitness, as screening and assessment

Memory screening
(With serious games)

Elements
- PAL test
- Bunnies test
- Planar test
- Mood test

Quick „pre-screening". Suitable for self-testing.

Addenbrook's Cognitive Examination (ACE) + Mini-Mental State Examination (MMSE)

Elements
- Orientation (time, space)
- Repeating words
- Anterograde memory
- Verbal fluency
- Naming pictures
- Spatial-visual exercises

Clinical screening and assessment. Semi-automated.

Memory screening

Suitable for self-testing.

Elements of memory screening

Targeted audience

1. 55+ years

2. Information from the participants

    1. Sex: man/woman/misc

    2. Year of birth

    3. Education (primary, secondary, tertiary)

Four activities (up to 2 weeks)

1. Bunnies test (execution, planning) x2

2. Planar test (execution) x2

3. PAL test* (visual memory, learning) x2

4. Mood test** (depression assessment)

*: Paired Associated Learning (PAL) assesses visual memory and new learning.

**: Geriatric Depression Scale - Short Form (GDS-SF).
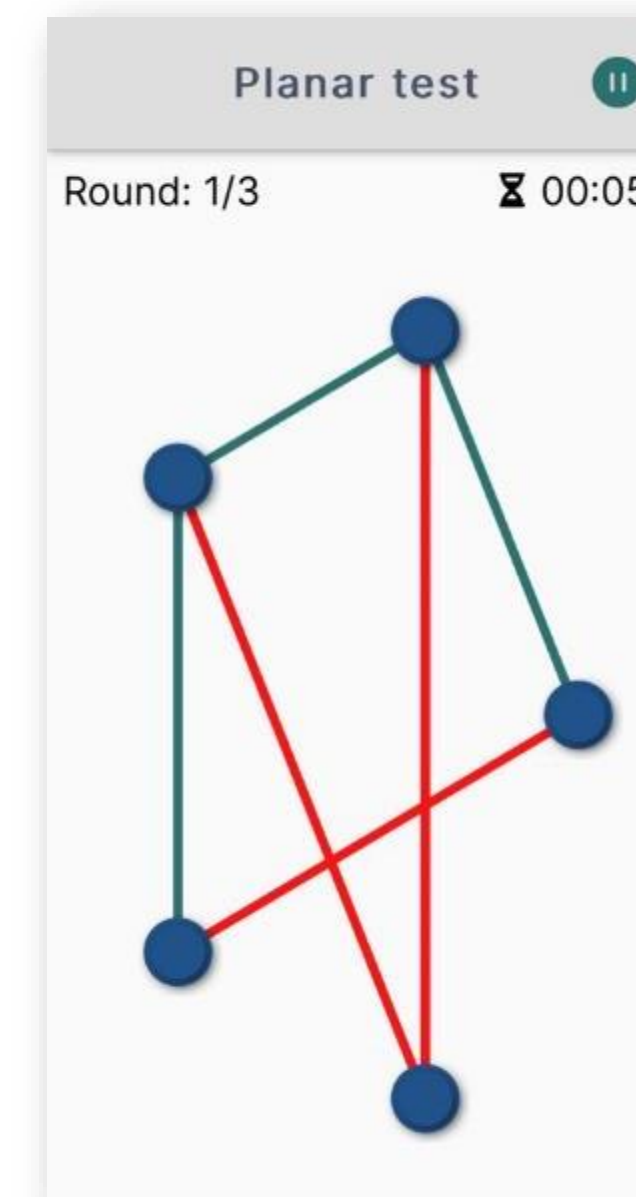
Memory screening - Demo

MentalFitness
Multilogic ◼ BME MIT

Screening Sheet 1 / 2

Participant Data

Nickname: Bogi
Identifier: 111111110 (TAJ)
Year of birth: 2023
Education: higher
Gender: woman

Screening Data ⚠

Type: memory screening
Region: Velence test
Interval: November 25, 2024 - November 25, 2024
Evaluation: further examination recommended

Test: Planar test

Result

The evaluation is based on the best of the prescribed number of gameplay scenarios:

excellent
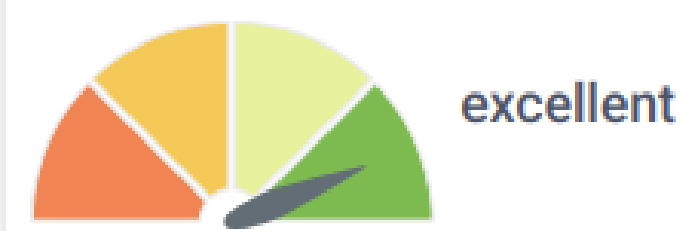
Running data of gameplays:

Run	Time	Score
1.	0:31	85
2.	0:31	85

Test: Bunnies test

Result

The evaluation is based on the best of the prescribed number of gameplay scenarios:

excellent

Running data of gameplays:

Run	Time	Score
1.	1:33	86
2.	0:56	87

Test: PAL test

Result

The evaluation is based on the best of the prescribed number of gameplay scenarios:

below average

Running data of gameplays:

Run	Time	Errors	Score
1.	8:26	42	78
2.	5:12	18	83

MentalFitness
Multilogic ◼ BME MIT

Screening Sheet 2 / 2

Participant Data

Nickname: Bogi
Identifier: 111111110 (TAJ)
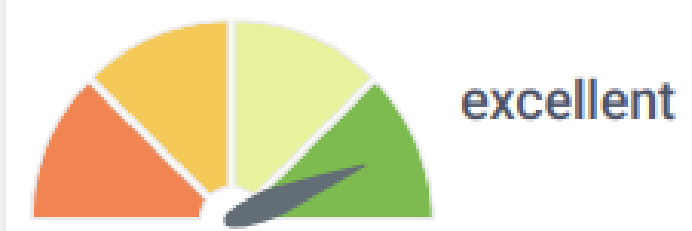Year of birth: 2023
Education: higher
Gender: woman

Screening Data ⚠

Type: memory screening
Region: Velence test
Interval: November 25, 2024 - November 25, 2024
Evaluation: further examination recommended

Questionnaire: Mood test

Result

The required questionnaire shows the state of mind is good, the mood is stable and there is no inner anxiety. These indicate that the mood seems to be good.

Run of the dialog

Index	Question	Answer
1	Are you basically satisfied with your life?	Yes
2	Have you lost interest in the things you used to do, have you lost activity?	No
3	Feeling empty in your life?	No
4	Are you often bored?	No
5	Is your mood generally good?	Yes
6	Are you afraid that some misfortune will befall you?	No
7	Do you feel happy in general?	Yes
8	Do you often feel hopeless?	No
9	Would you rather stay in your home than go out and try new things?	No
10	Have you had problems with your memory recently?	No
11	Do you feel it is a great thing to live?	Yes
12	Do you feel useless, worthless in your current situation?	No
13	Do you feel full of energy?	Yes
14	Do you feel that your situation is hopeless?	No
15	Do you feel that the majority of people are more valuable than you?	No

Addenbrook's Cognitive Examination and Mini-Mental State Examination

Clinical screening and assessment. Semi-automated.

Elements of ACE and MMSE

ACE is a cognitive screening tool used to assess cognitive functioning, particularly in neurodegenerative conditions like dementia.

It evaluates five key cognitive domains - **22 questions**:

Attention	Tasks include orientation questions (e.g., time and place) and serial subtraction exercises.
Memory	Tests recall and recognition of words, memory for a name and address, and delayed recall.
Verbal Fluency	Measures category fluency (e.g., listing animals) and phonemic fluency (e.g., words beginning with a specific letter).
Language	Includes tasks like naming objects, repetition of phrases, comprehension, and writing.
Visuospatial Abilities	Assesses skills like copying geometric shapes, drawing a clock face, and recognizing objects.

MMSE is is a brief cognitive screening tool used to evaluate cognitive function and detect cognitive impairment.

It assesses five key areas - **9 tasks**:

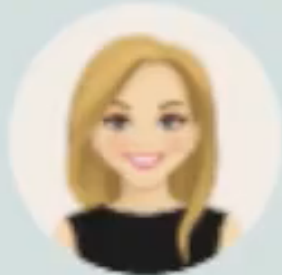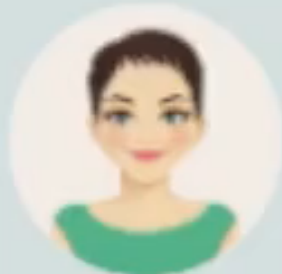|	
Orientation	Questions about time (e.g., year, season, date, day, month) and place (e.g., country, city, building).
Registration	Immediate memory test, where the individual is asked to repeat three unrelated words.
Attention	Tasks like serial 7s (subtracting 7 from 100 repeatedly) or spelling a word (e.g., "WORLD") backward.
Recall	Delayed recall of the three words given during the registration task.
Language and Praxis	Includes naming objects, repeating phrases, reading and obeying a written command, writing a sentence, and copying a geometric design.
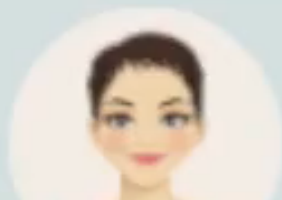
ACE - Demo

ACE – Report (extract)

MentalFitness — Examination Sheet 1/6
Multilogic BME MIT

Patient Data
- **Nickname:** Aliz
- **Identifier:** 000000017 (TAJ)
- **Year of birth:** 1955
- **Education:** secondary
- **Gender:** female

Examination Data
- **Type:** ACE
- **Region:** Velence
- **Date&Time:** 2024. november 18. 13:28
- **Duration:** 19 m 30 sec
- **Evaluation:** well-detectable decline

Total score: 83/100

Orientation:	6/10
Concentration:	7/8
Memory:	31/35
Verbal fluency	11/14
Language:	23/28
Visuospatial abilities:	5/5

Test: Orientation in time (1.a) — Duration: 62 sec — Score: 1/5

Question	correct answer	one answer, but wrong	several answers, including the correct	other:	does not know
What year are we in?	✓				
What season is it?		✓			
What time is it today?			✓		
What day is it today?				✓	
What month are we in?					✗

Test: Orientation in space (1.b) — Duration: 15 sec — Score: 5/5

Question	correct answer	one answer, but wrong	several answers, including the correct	other:	does not know
Where are we now? In which country?	✓				
In which county?	✓				
In which city?	✓				
In which building?	✓				
On which floor?	✓				

Test: Repeating words (2.) — Duration: 30 sec — Score: 3/3
I'll tell you three words in a row. Please listen to the words first, then repeat all three. Lemon, key, ball.
1. lemon ✓
2. ball ✓
3. key ✓

Test: Counting/spelling backwards (3.) — Duration: 29 sec — Score: 4/5
- Count backwards by sevens starting from 100! 93 ✓ 86 ✓ 79 ✓ 72 ✓ 65 ☐
- Spell the word 'WORLD' backwards! D ✓ L ✓ O ☐ R ☐ W ✓

Test: Recall words (4.) — Duration: 39 sec — Score: 2/3
Do you remember the three things I asked you to repeat earlier? Recall them again.
1. lemon ✓
2. key ✓
ball ☐

Test: Anterograde memory (5.) — Duration: 19 sec — Score: 21/21
I will read you a name and an address. After you have listened, please repeat them.
Harry Barnes, 73 Orchard Close, Kingsbridge, Devon county

	Harry	Barnes	73	Orchard	Close	Kingsbridge	Devon county
1. trial	✓	✓	✓	✓	✓	✓	✓
2. trial	✓	✓	✓	✓	✓	✓	✓
3. trial	✓	✓	✓	✓	✓	✓	✓

Test: Retrograde memory (6.) — Duration: 29 sec — Score: 1/4

Who is the current Prime Minister?

correct answer ✓	prime minister, but not the current	other politician
other public figure	other:	does not know

Who was a female Prime Minister?

correct answer	former prime minister, but not female ✓	other politician
other public figure	other:	does not know

Who is the USA president?

correct answer	US president, but not the current	other US politician ✓
other US public figure	other:	does not know

Who was the USA president who was assassinated in the 1960s?

correct answer	former US president, but not the one who was assassinated in the 1960s	other US politician
other US public figure	non-US person	other:		does not know ✗

Test: Letter fluency (7.) — Duration: 214 sec — Score: 6/7
Please say as many words starting with 'p' as you can think of in 1 minute!
Do not use personal names and place names, because they do not count!

- Number of words given in response: 19
- Number of acceptable words: 16
- Perseverance: no

1. place 2. party 3. project 4. power 5. pose 6. pencil 7. pig 8. pain 9. pork 10. ~~Peter~~
11. pluralism 12. parliament 13. ~~pencil~~ 14. ~~ball~~ 15. probe 16. problem 17. pardon 18. punish 19. punishment

Test: Wire cube (21.) — Duration: 34 sec — Score: 1/1
Please copy the figure on the sheet of paper into the blank space next to it.

the drawn figure is the spatial shape with the same number of vertices as the original ✓

Test: Clock face (22.) — Duration: 55 sec — Score: 1/1
Please draw a clock face in the blank space on the sheet of paper. Draw the numbers and the hands so that the clock measures 5 hours 10 minutes.

- drew the circle ✓
- the numbering is correct ✓
- the hand position is correct ✓

Memory screening vs. MMSE vs. ACE

Comparison of the different tests

Feature	Memory screening	Mini-mental State Examination	Addenbrooke's Cognitive Examination
Purpose	Self screening	Screening for cognitive impairment	Comprehensive cognitive assessment
Domain assessed	Four: Execution, Planning, Visual memory, Learning	Five: Orientation, Registration, Attention/Calculation, Recall, Language	Five: Attention, Memory, Fluency, Language, Visuospatial
Total score	Statistical scores	30	100
Scoring breakdown	Bunnies, Plannar PAL – well founded test	Simple cumulative score	Subdomain scores allow detailed analysi
Time required	30 minutes	5–10 minutes	15–20 minutes
Sensitivity	-	Moderate, may miss mild impairments	Higher, suitable for detecting early dementia (e.g., Alzheimer's)
Goal	Self assessment	Trained social workers	For experts
Utility	Quick, ideal for self pre-screening	Quick, ideal for routine well-established screening	Detailed, aids in diagnosis and management
Complexity	Simple, no administration	Simple and easy to administer	More complex and detailed

Mobil ✅ + Tablet ✅ + Web ✅

MentalFitness Player   **MentalFitness Doc**

Android applications

- Available on the Google PlayStore
- Required Android version: 5.1+
- Player cca. 50 MB; Doc cca. 10 MB

iOS applications

- Available on the Apple AppStore
- Required iOS version: 13+
- Player cca. 50 MB; Doc cca. 10 MB

Web applications

- https://mentalfitness.multilogic.hu/player
- Chrome, Firefox, Safari browsers are tested