IO1 Cognitive skills based training scheme for seniors

Tablet-Based Cognitive Gaming Platform for seniors

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Co-funded by the
Erasmus+ Programme
Of the European Union

Aim

Providing a comparative report of finding with recommendations derived in the framework of the IO1 Cognitive skills-based training scheme for seniors of Erasmus+ project Tablet-Based Cognitive Gaming Platform for seniors.

- On one hand, it illustrates main findings obtained in Austria, Belgium, Bulgaria, Cyprus, Turkey and France from the *desk research* on the current situation of education system for adults as well as existing best practices in the field
- On the other hand, the results received from the *survey questionnaire* that was aimed to analyse seniors' level of cognitive skills and Learning needs.

Despite all the knowledge and information, the six partners have in the context of the project's objectives, found also very important to update and access accurate information within the scope of the project. This paper is an initial cornerstone giving the further directions and mainly contextualizing the next intellectual outputs.

Methodology

Project partners created a survey questionnaire for analysing seniors' level of cognitive skills and learning needs, and the challenges they face in their daily lives. This questionnaire was then translated by each partner in their local languages and populated online and disseminated for completion by around 100 seniors per country. Subsequently, each partner summarised, analysed and reported their local results on *national reports*, which are now consolidated in *a common comparative report* prepared by E-Seniors. In parallel, each partner will realize a desk research about existing cognitive games with a description of good practices and the adult education system in respective countries.

Once the aforementioned needs analysis survey is completed, each partner will create certain cognitive skills *learning objects* that address the following dimensions of cognition (memory, attention, visual perception, reasoning and planning, processing speed, and sequential processing) and the results obtained through the survey.

Based on the above results, different *scenarios* will be implemented in partner countries during focus groups which will involve also experts working with seniors. Finally, partner E-Seniors will work on the *training scheme*, which will include the training needs, objectives, action plan, initiatives, resources and assessment methods. This scheme will be also translated in all partners' languages.

Tablet-Based Cognitive Gaming Platform for seniors

2018-1-TR01-KA204-058258

IO1 Prepare cognitive skills learning objects according to the need analysis survey

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1. Overview games

Below is an overview of the games, developed in the context of the Tablet-Based Cognitive Gaming Platform for Seniors (2018-1-TR01-KA204-058258), whereby emphasis was put on motivation and engagement of the target users (55+)

- **Memory (Picture Fit)** – a game to help with skills about storing and recalling small amounts of information
- **Attention (Pats)** – a game to help with skills about staying focused and on task for a certain period of time and handling more than one thing simultaneously
- **Visual perception (Fit the Box)** – a game to help with skills about perceiving, analyzing and thinking via visual images
- **Reasoning and planning (Puzzle Cubes)** – a game to help with skills about reasoning, planning and forming ideas, deciding how to solve a problem, checking for mistakes and modifying where needed
- **Processing speed (Lava Trip)** – a game to help with skills about performing cognitive tasks quickly (important skill for complex tasks with many steps)
- **Sequential processing (Dice Maze)** – a game to help with skills about linking a series of inputs over time, a series of sounds to create words, a series of words to understand the story/idea

2. Technical specifications

The games platform has been developed on Unity 3D game engine (https://unity.com/). It has been produced for an Android platform as an APK file format. It is suitable for Android Tablets and Android mobile devices in general, with version of Android 4.0 or newer.

Based on the user-driven consolidation of requirements, we created a list of technical specifications that guided the designs and developments of all individual games, as well as the integrated game platform. These are listed in the following:

Functional:

- Games to be developed in Unity3D, to have a common platform and make it easier for the integration into one game platform.
- Games, as well as the integrated game platform to be 3D, still respecting the user requirement to avoid much complexity.
- Games to have point and click, draggable objects.
- Games to have animations.
- Games to use hotspots
- Games to use easy sound and text, to also facilitate simple multilingualism.
- Games to avoid implementing very complex logic; i.e., to avoid games-in-game, avoid extensive animations (only the necessary and engaging ones), avoid having to apply complex controls on the objects manually. The latter is usually easier with a keyboard but not with fingers, while on a tablet device, a joystick type of controller might be difficult to use for older players.

- Games to have multiple levels, starting from the easy and moving to more difficult as the player succeeds in the game objectives.
- Games to offer the option to choose between the levels manually as well.
- Games to avoid too fast movement of objects, at least for the lower levels.
- Games to avoid objects of very small size.
- Games to use assets that are visible in terms of accessbility, i.e. considering the colour, contrast, etc.
- Games to give at the beginning the options: "Play", "Levels", "Exit".
- Games to have option to turn on/off the sound

- Upon success, games to show message (and audio) of the form "Hoorey!".
- Upon game ending without very good performance, games to show a message (and audio) of the form: "Not bad, try again.
- "When the level changes, games to trigger a message (and audio) saying something like “Bravo” or "Well done".
- Games to be multilingual, covering at least all partner languages, plus the English which is the project's working language.
- Games to be provided as selections in an integrated game platform.
- The game platform to offer option to select language or be provided in separate language versions.
- The game platform to present all funding agency logos and respect the dissemination/communication specifications.
- The game platform to be provided through Google Play, free of charge and without barriers to the end-users.

Non-Functional

- **Security:** there are no special security specifications for the games of the game platform. However, the implementation must be such that the app will not compromise the security of the users' devices in any way.
- **Data management and protection:** the game developments should avoid any link to the personal data of the user/player. The games will not store any data, beyond the score keeping for the session time.
- **Interoperability:** The game platform to consider scalability at its core, to facilitate the integration of additional games in the future, either by the partners or by third party contributions. Third parties will need to first contact the consortium at info@games4seniors.eu and receive instructions on how to prepare the games to be integrate-able to the game platform.
- **Usability:** The games must be easy to use and self-explanatory, with no need for the player to read user manuals, further to the instructions on the game screens.
- **Accessibility:** The games to be readily accessible by users 55+, adding no barriers and, where possible, facilitating the access of users with any type of disability.
- **Speed:** The games must be able to run without problems on the pre-defined devices/platforms.

3. Aim of the Learning Objects

3.1.Memory

3.1.1.Learningmaterialrelatedto“Memory”

This section contains two games which aim to stimulate the memory and that can help with skills about storing and to recall small amounts of information.
Memory is defined as the ability and process to recover information about past events or knowledge. During this process the brain engages in a remarkable reshuffling process to extract what is general and what is about each passing moment. Memory may be divided into short-term (also known as working or recent memory) and long-term memory. Short-term memory recovers memories of recent events, while long-term memory is concerned with recalling the more distant past (Shiel, 2018).
Contrary to old academic consensus, it is proven that the memory andthe brain are similar to regular muscles and can improve or degrade at any age, even though the ratio of the progress may change according to age. This chapter aims to define the learning objectives of the senior-focused memory games that is produced as an output of the project “Tablet Based Cognitive Gaming Platform for Seniors”.

3.1.2.LearningObjectives

- To improve memory and related cognitive capacity via mental exercises on a tablet game platform.
- To enhance mnemonics through retrieval of semantic items and images.
- To improve memory muscles through repetition and exercises.
- To provide gradual and measurable improvement of the memory capacity with escalating difficulty levels of exercises.
- To make sure even the people with lowest memory level can play and show progress, via offering simple and intuitive design and interface.
- Improve concentration and attention to utilize memory better
- To enhance power of recognition
- Hence, enhance the overall cognitive skills to improve the quality of life of elderly person.

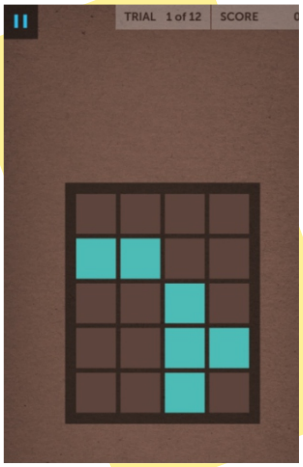
3.1.3.Analysisofcurrent2D/3Dapps(seeinputfromIO2,A2):

3.1.3.1.MemoryGameswithAnimals

Memory Games with animals is a fun memory training game with many graphics and sounds. The objective is to test the users memory. Initially all the cards are faced down. The user begins by tapping on two cards , if the cards are not the same they will be covered up again, the purpose is to try to remember the matching cards. The player can choose and control the difficulty of the game (Easy, Medium, Hard) and there are different card categories.

3.1.3.2.MemoryMatrix

This game begins by showing some highlighted squares which are going to be turned around, the user has to try and remember which where the highlighted tiles and find the once they are brown again. The difficulty of the game keeps on increasing on each advancing stage.

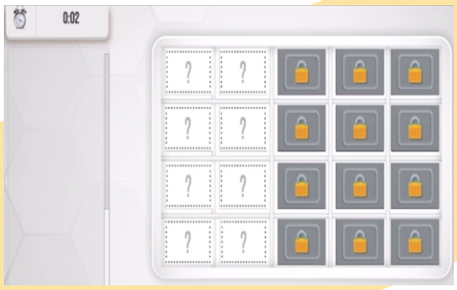


3.1.4.Assessment:

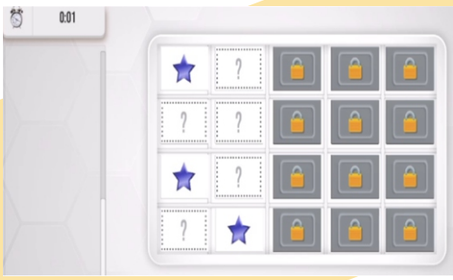
- The user will be assessed by the levels in the game. Higher level will correspond to a higher cognitive ability.
- If the user cannot pass the initial levels, he or she will be advised to consult with a medical professional.
- User will be given additional assessment tools during piloting and online-assessment.

3.1.5.2. Hidden Boxes

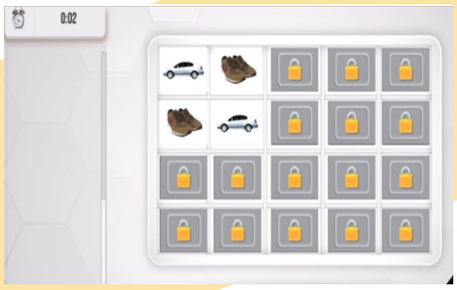
Box Matching.



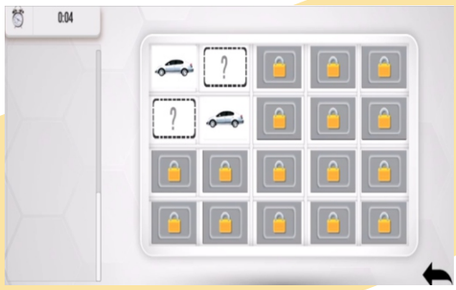
This is a classical memory game that allows you to memorize items in a couple and then match them. Observation is important.
Once the boxes are closed, click on the boxes that have the same item inside.



It is a game that can help with skills about storing and to recall small amounts of information. It requires observation, concentration and a good memory to win.
The final goal of this game is to exercise cognitive skills related to memory.



●This game's purpose is to match each card to its identical pair. At the beginning a set of 4 cards are shown (2 pairs of cards), and the player must try to really pay attention to the cards shown and then they will flip back.
he player chooses a card and turns it over, then proceed to turn over the corresponding pair.



●Hidden Boxes is a game that begins with some open boxes , the player has to memorize where the stars are. After a few seconds the boxes will close. Once the boxes are closed, the player must click on the boxes that have stars inside.
Each try, you can click only an equal number to the given stars. If you make a mistake, try again as many times as you like.

3.1.7. Innovation of the game implemented in context of TBC4Seniors Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Box Matching and Hidden Boxes

- The game gradually increases the complexity in each level, allowing gradual increase of challenge for the player.
- In this game the contrast levels are adapted to those needed for the target users.
- Swipe gestures are trained and repeated in a gamified mode.
- Clear concepts and images are presented so the player can better adapt to the game, not finding extremely colourful images that can be confusing to the eyesight.

3.2.Attention

3.2.1. Learning material related to "Attention"

Attention is a cognitive process is the selective concentration on one aspect of the environment. Attention is critical for everyday performance. Attention is a selection process for an external (sound, image, smell...) or internal (thoughts) event which has to be maintained at a certain level of awareness. It is not a stable but rather a fluctuating skill. Attention is critical for encoding information, so poor attention could ultimately lead to poor long-term memory as well.This chapter aims to define the learning objectives of the senior-focused attention games that are produced as an output of the project "Tablet Based Cognitive Gaming Platform for Seniors".

3.2.2.Learning Objectives:

- Select and focus on relevant stimuli
- Focus on something while ignoring other things
- Shift attention between one task and another
- Maintain attention over time
- Identify more quickly and more accurately than are features belonging to different objects
- Task switching to rapidly and efficiently adapt the different situations.
- Simultaneous use of spatial and temporal attention
- Pay attention to tasks, details and organizing tasks /events
- Coping with different stimuli or actions at the same time
- Relevant and the filtering out of irrelevant information
- Attention to multiple pieces of information in the same modality
- Performing multiple tasks simultaneously

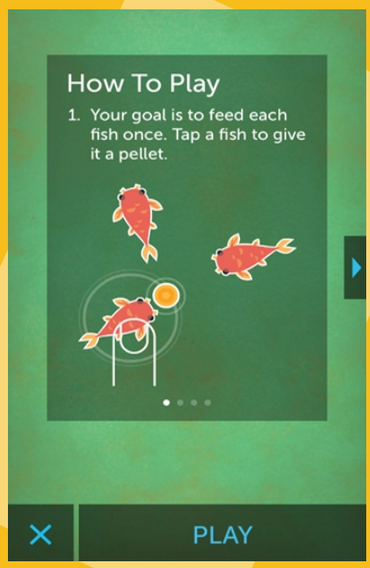
3.2.3.Analysis of current 2D/3D apps (see input from IO2, A2):

3.2.3.1.Train of Thought

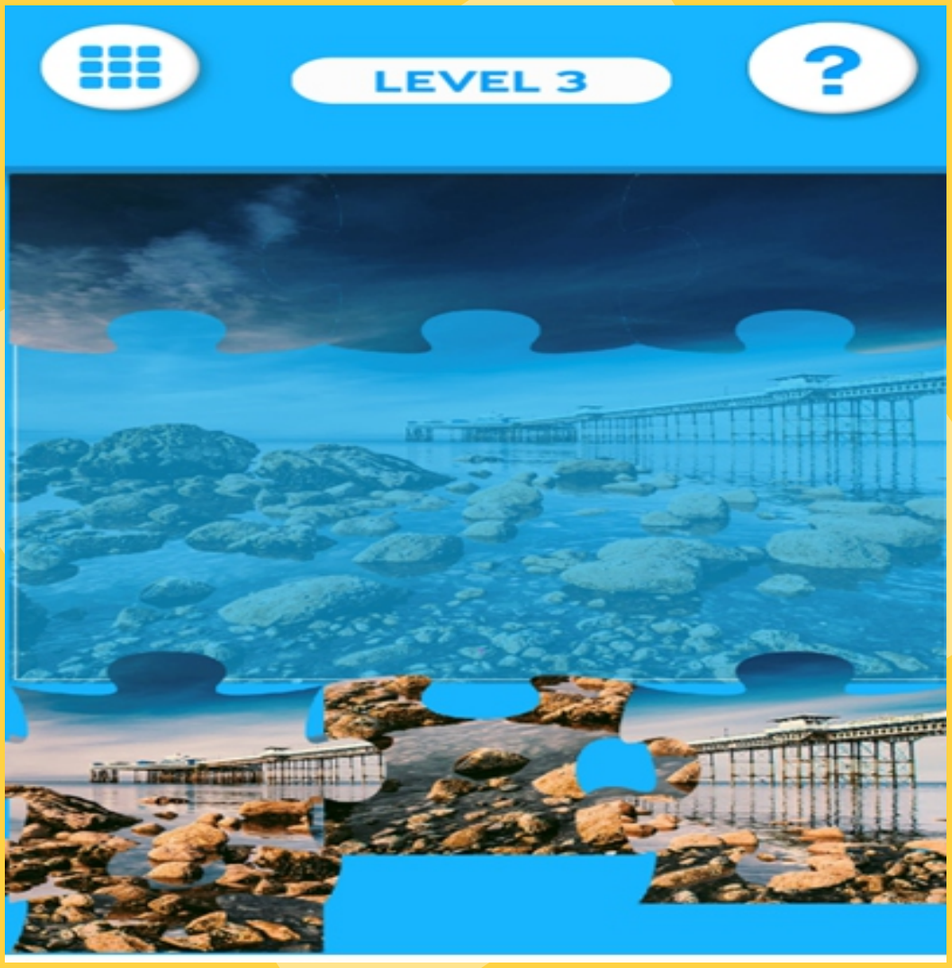
Train of Thought is a game design to test and put in practice the ability to process multiple streams of information, one must guide the train to the same color station, multiple trains are coming also coming one after the other so one must plan ahead the routes that the trains should take and stay alert at the colors of the trains.

3.2.3.2.Playing Koi

Playing Koi is a game centered in the area of divided attention and the ability to process multiple streams of information. The goal of the game is to feed each fish once by tapping them, the player has to remember which fish has already been fed, the number of fish will keep increasing per level.



3.2.3.3.Attention Games: Puzzle

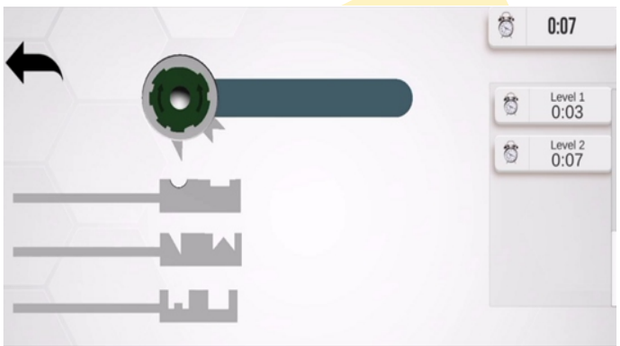


3.2.4.Assessment

- The user will be assessed by the levels in the game. Higher level will correspond to a higher cognitive ability.
- If the user cannot pass the initial levels, he or she will be advised to consult with a medical professional.
- User will be given additional assessment tools during piloting and online-assessment.

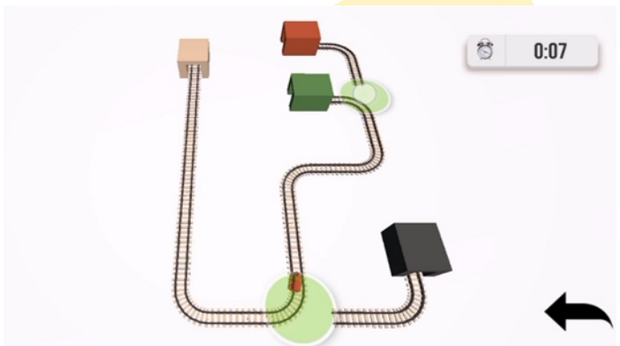
3.2.5.. Implemented game in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258:

3.2.5.1.Wheel Match



Wheel Match: This game allows you to improve your focus on details. Match the pattern of the wheel to the linear key. This game also stimulates 3-dimensional thinking.

3.2.5.2. Train



Train: Direct each train to the correct station.Just make sure the red train goes to the reds tation, the green train goes to the green station. The player can change the direction of the rails simply by clicking them.

3.2.6.Training strategies of the game

- Interactive game design
- Containing negative stimuli, increasing the focusing capacity, distinguishing sounds perform two or more tasks or process two or more sources of information concurrently
- Providing attention, sometimes attracting attention to different areas, short-term tasks according to the speed of selection of objects
- Difficulty level increasing in a fun way
- Simple design with high resolution for easy understanding and accessibility.

3.2.7. Innovation of the game implemented in context of TBC4Seniors Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Wheel Match and Train

- The game gradually increases the complexity in each level, allowing gradual increase of challenge for the player.
- In this game the contrast levels are adapted to those needed for the target users.
- Spatial dimensions are accentuated, to give more depth and clarity to the games.
- Visual orientations are stimulated.
- Swipe gestures are trained and repeated in a gamified mode.

3.3.Visual perception

3.3.1. Learning material related to "Visual perception"

This game will focus on the activities based on visual perception training for the elderly people for the project "Tablet Based Cognitive Gaming Platform for Seniors".

Visual perception is defined as the total process responsible for the reception (sensory functions) and cognition (specific mental functions) of visual stimuli. The sensory function or visual-receptive component is the process of extracting and organizing information from the environment, and the specific mental functions that constitute the visual-cognitive component provide the capacity to organize, structure, and interpret visual stimuli, giving meaning to what is seen. Together these two components enable a person to understand what he or she sees, and both are necessary for functional vision. Visual perceptual skills include the recognition and identification of shapes, objects, colours, and other qualities. (Reference: Visual perception - CM Schneck - Occupational Therapy for Children. sixth ed. Mosby Inc, 2005).

Functional problems in this area may cause difficulties with eating, dressing, reading, writing, locating objects, driving, etc. As visual and hearing systems are known as being the two most important system to help a person to understand the environment inside and outside of their bodies, when one of those systems are affected somehow, it can cause problems in a person's life. This game aims to prevent this.

How aging affects the visual perception in people? As we get older many areas of our brains start to get affected, visual perception and task performance can be one of them. It is well established that older adults show a perceptual deterioration in the detection of low-level local features of objects, such as orientation, contrast sensitivity, and spatial frequencies (Derefeldt, Lennerstrand, & Lundh, 1979; D. B. Elliott, Whitaker, & MacVeigh, 1990; S. L. Elliott et al., 2009; Kline, 1987; Kline & Schieber, 1985; Kline, Schieber, Abusamra, & Coyne, 1983; Owsley, Sekuler, & Siemsen, 1983; Ross, Clarke, & Bron, 1985; Tulunay-Keesey, VerHoeve, & Terkla-McGrane, 1988).

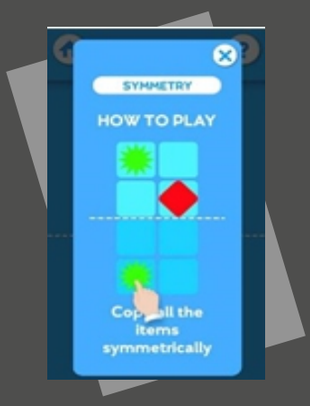
Aging people can be checked regarding problems with visual perception using e.g. the Development Test of Visual Perception (DTVP). See explanation for such test at https://www.sig-net.be/uploads/werkgroepen/een_kijk_op_het_oog/dtvp2.pdf (in Dutch).

3.3.2. Learning Objectives

- To improve visual perception and related cognitive capacity via mental exercises on a tablet game platform
- To improve how the person perceives, analyses, and thinks in visual images
- To improve visual perception connections through repetition and exercises
- To provide gradual and measurable improvement of the visual perception capacity via exercises with escalating difficulty levels
- To make sure that even the people with lowest visual perception level can play and show progress, via offering a simple and intuitive design and interface
- To improve concentration and attention so as to improve visual perception
- To enhance power of recognition
- To enhance the overall cognitive skills, thus improving the quality of life of elderly person.

3.3.3.Analysis of current 2D/3D apps (see input from IO2, A2):

3.3.3.1.Matching Game (Symmetry)



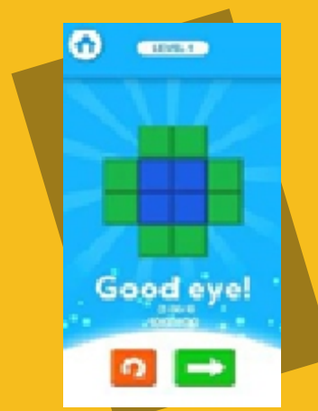
Before the users start playing there will be a “How to Play” display to help them through it. The user will have a square image with geometric symbols in a side and the other side in a blank must be completed equal ways to it, so you can pass the phase and the levels of difficulty will increase.
But in the first phases only the geometric shapes and colours of the symbols will change, so the user can adapt themselves to it and be motivated to continue. After all levels the user will get an overall feedback about their points through the game.

3.3.3.2 .Number Scale

Before the users start playing there will be a “How to Play” display to help them through it. The users will have to visualise the right position to point in the scale, and as the levels are passed more difficult it gets with the numbers increasing. Even if the user don't get it right he can choose to re done the phase or to go
k about their points through the game.

3.3.3.3.Block Puzzle

Before the users start playing there will be a “How to Play” display to help them through it. Users will have to visualise, recognize and connect the coloured shapes to the shaded picture in the middle. Even if the user don't get it right he can choose to redone the phase or to go to the next, but a tip is giving at the end of each level, saying it is “good, keep going” or “you should try it again, I am sure you will get it”.
After all levels the user will get an overall feedback about their points through the game.



3.3.3.4. Drawing Game

Before the users start playing there will be a “How to Play” display to help them through it. The game will display a range options of colours and images to be picked by the user to colour. More elaborated drawings can be picked to colour, or simpler ones. This game aims to stimulate the visual perception and relaxation of the user.

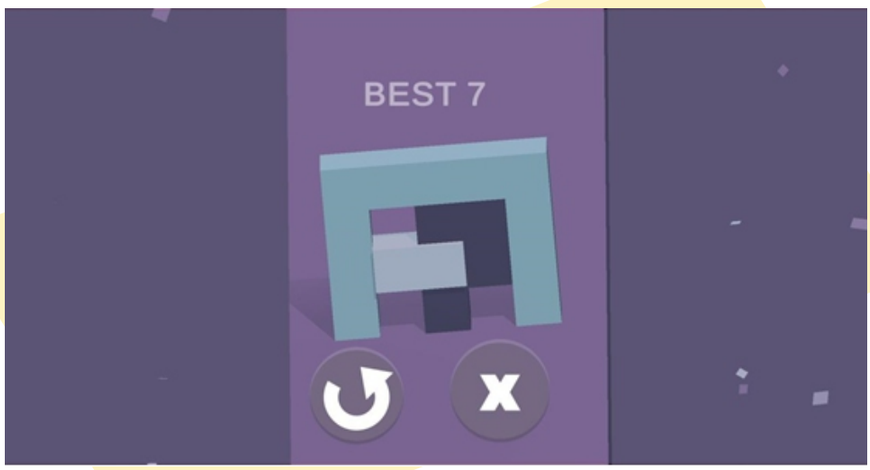
3.3.3.5. Matching Game

Before the users start playing there will be a “How to Play” display to help them through it. Users have to find pairs of matching tiles before the time runs out to see the place where all the objects in the small pictures can be found (e.g. kitchen, bedroom, hospital, park, school, living room, etc.). The user must clear all the blocks within the designated time frame, which they will be able to pick if before the game starts, if they want 30 secs, 1min, “good, keep going” or “you should try it again, I am sure you will get it”, etc. After all levels the user will get an overall feedback about their points through the game.

3.3.4.Assessment:

- The user will be assessed by the levels in the game, if he/she is able to pass the levels there will be a score given at the end of each phase.
- If the user cannot pass the basic and medium levels it will be advised to look for an Ophthalmologist to get your eyes checked.
- If the user can keep passing the levels, he/she will be stimulated to keep going or given tips how to stimulate their visual perception more on a daily basis.

3.3.5.Implemented game in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Fit the box



3.3.6.Training Strategies of theGame:

- This game uses with an interactive game design platform
- Stimulating visual perception with different images/shapes and colours
- Applying right amount of stress on cognitive functions for measurable progress via motivation, continuity and giving tips
- Simple design with high contrast for easy understanding and accessibility, where the user can easily learn how to make use of the platform, giving previous tips before the game starts on how to use it.

3.3.7.Innovation of the game implemented in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Fit the box

- **The complexity level gradually seamlessly increases**
- **The training mode is embedded in the gaming by considering training duration, duration of similar building blocks, and gradual increasing levels, each time with a training approach at the very beginning.**
- **The game logic focuses on simplified yet more complex evolving visual concepts, using a recurrent similar shape (rectangular boxes).**
- **Spatial dimensions are accentuated.**

3.4. Reasoning and planning

3.4.1. Learning material related to “Sequential Processing”

This game will aim at reinforcing the learning capacities for reasoning and planning at older adults in the framework of the project Tablet Based Cognitive Gaming Platform for Seniors. Reasoning ability is something that your mind actually thinks why what and how. It is the ability to take the inputs from 5 sensory organs, process the data and give the relative solution. The only way to test reasoning ability is taking a problem solving it and checking the time taken for the problem to be solved. Planning is a fundamental cognitive skill that forms part of our executive functions. Planning can be defined as the ability to "think about the future" or mentally anticipate the right way to carry-out a task or reach a specific goal. Planning is the mental process that allows us to choose the necessary actions to reach a goal, decide the right order, assign each task to the proper cognitive resources, and establish a plan of action.

3.4.2.Learning Objectives

- To challenge executive functioning
- To improve processes of logic, strategic planning, problem solving, and deductive reasoning
- To manage interferences
- To solve problems and tasks on different levels of difficulty
- To solve problems in a defined period of time
- To improve capacities such as planning, abstract thinking, cognitive flexibility, rule acquisition and selecting relevant information
- To define an appropriate strategy to reach the solution

3.4.3. Analysis of current 2D/3D apps (see input from IO2, A2):

•3.4.3.1. Sum of numbers

Focus: Speed calculation

- Add up numbers until the target number “cible” is reached
- The target number to reach appears on the top of the screen and a selection of numbers are available below. You have to click on numbers which will indicate the sum of the target number above. Those numbers will disappear and the target number will change afterwards. This task will be repeated until all numbers disappear.
- The level of difficulty increases at each level

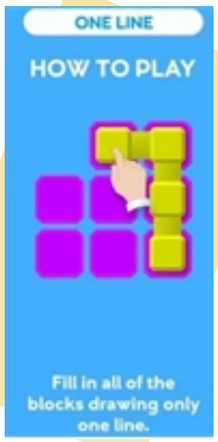
Focus: Speed calculation

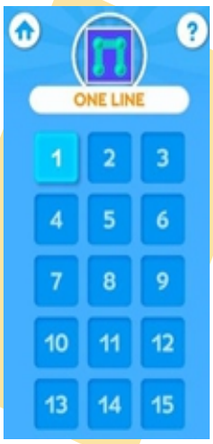
- Add up numbers until the target number “cible” is reached
- The target number to reach appears on the top of the screen and a selection of numbers are available below. You have to click on numbers which will indicate the sum of the target number above. Those numbers will disappear and the target number will change afterwards. This task will be repeated until all numbers disappear.
- The level of difficulty increases at each level

3.4.3.2. One line

Focus: Logic reasoning

- Fill in all of the blocks drawing only One line.
- You will have to mark all the block with one line with your finger on a touch screen.
- The idea is to start from one point and keep slipping the line through all the points without interrupting or going twice thorough the same point.
- You will be starting from the Level 1 and since you move forward with first level, more levels will be unlocked.





3.4.3.3. Tower of Rings

Focus: Problem-solving

- Rebuild the tower of rings by making strategic moves
- Configure colored rings on a series of pegs in order to match a target. Possibility to move the top-most ring on each peg to another peg, but you can only move one ring at a time and you can never put a larger ring on top of a smaller ring.
- You must define a strategy to reach a desired outcome, calculate the right moves to reach the solution in the shortest possible time, and remember the rules of the exercise.

3.4.3.4. Piko's cube

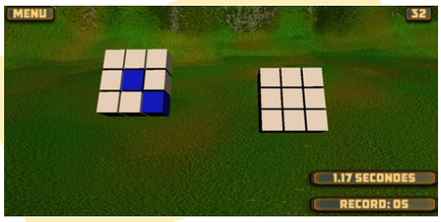
Focus: logic reasoning

- Choose the language you prefer for your game and click on play
- There are two sides on the screen: figure already that is to be reproduced and the blank space where you should recreate the same figure with your cubes by touching the screen
- The patterns will get harder as you successfully advance with each figure
- Cubes will be shown in 3D version with several layers sometimes
- You will be starting from the Level 1 and since you move forward with first level, more levels will be unlocked.

3.4.4. Assessment

- The user will be assessed by the levels in the game. The game will start with the easiest first level and as long as the user passes this level, more levels will be unlocked. Higher level will correspond to a higher cognitive ability.
- If the user cannot pass the initial levels, he or she will be advised to try again.
- User will be given additional assessment tools during piloting and online-assessment.

•3.4.5. Implemented game in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Puzzle Cubes



3.4.6. Training strategies of the game

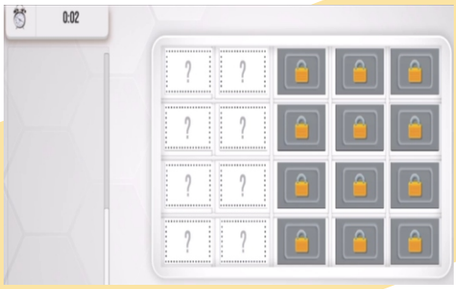
- Interactive game design and easy and intuitive instructions
- Applying right amount of stress on cognitive functions for measurable progress via enforcing time limitation or increasing difficulty
- Rewarding the improvement to build motivation and continuity.
- Simple design with high contrast and bright colors for easy understanding and accessibility

3.4.7. Innovation of the game implemented in context of TBC4 Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Puzzle Cubes

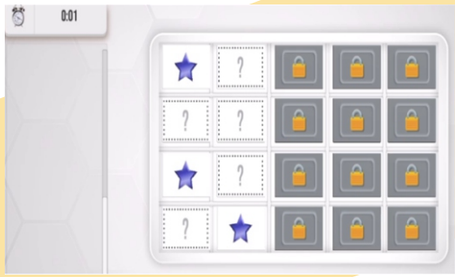
- Contrast colors blue and grey to be differentiate easily by older persons
- Big cubes sizes for vision perception of seniors
- Difficulty level is integrated in the game and automatically changes once the previous level is completed successfully.
- Easy and efficient way to stimulate reasoning ability by planning each strategic move in order to achieve the required result.
- Rotation background allow to see the picture and the volume of the cube from different perspective

3.1.5.2. Hidden Boxes

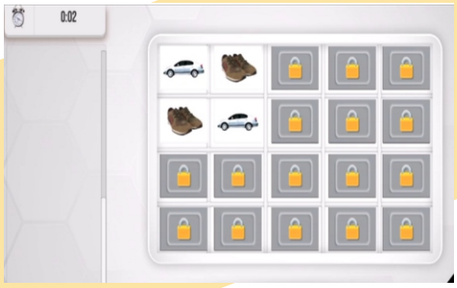
Box Matching.



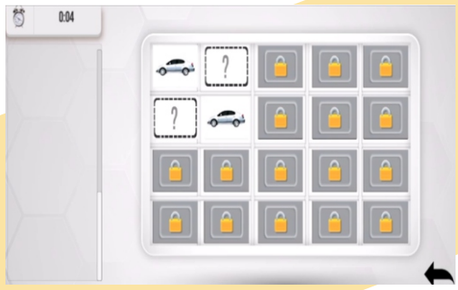
This is a classical memory game that allows you to memorize items in a couple and then match them. Observation is important.
Once the boxes are closed, click on the boxes that have the same item inside.



It is a game that can help with skills about storing and to recall small amounts of information. It requires observation, concentration and a good memory to win. The final goal of this game is to exercise cognitive skills related to memory.



●This game's purpose is to match each card to its identical pair. At the beginning a set of 4 cards are shown (2 pairs of cards), and the player must try to really pay attention to the cards shown and then they will flip back.
he player chooses a card and turns it over, then proceed to turn over the corresponding pair.



●Hidden Boxes is a game that begins with some open boxes , the player has to memorize where the stars are. After a few seconds the boxes will close. Once the boxes are closed, the player must click on the boxes that have stars inside.
Each try, you can click only an equal number to the given stars. If you make a mistake, try again as many times as you like.

3.5.Processing speed

The present document discusses the “Processing Speed” as one of the six dimensions of cognition addressed by the project “Tablet Based Cognitive Gaming Platform for Seniors”. The information provided here aims to guide the development of the relevant game, which will focus on “processing speed”, as well as to provide accompanying material for trainers of older adults to use when working on improving the processing speed skills of their trainees.

The following sections help the reader understand the concept of “processing speed”, its importance in our interaction with the environment and its link to the process of aging and the process of training to keep good levels of processing speed while we grow older.

3.5.1.Learning material related to “Processing Speed”

3.5.1.1.General definition of Processing Speed

“Processing speed is the ability to **identify**, **discriminate**, **integrate**, **make a decision** about information and respond to visual and verbal information. (Holdnack, J et al. 2016). In other words, processing speed is the cognitive ability that could be defined as the time it takes for a person to do a mental task or the time between receiving and responding to a stimulus. It is related to the **speed** in which a person can **understand and react** to the information they receive, whether it be visual (letters and numbers), auditory (language), or movement.

3.5.1.2.Examples of cognitive processing speed

Processing speed is a skill used in exercises when recognizing simple visual patterns, visual exploration tasks, taking tests that require simple decision making, doing basic mathematical calculations, manipulating numbers, or doing a reasoning task under pressure. The following are examples of cases that would raise alarm of low processing speed:

- The time needed to complete a task compared to the time needed by others. For example, if others can complete a certain task in 20 minutes while the subject person needs e.g., 40 minutes.
- Difficulties following instructions.
- Difficulties on planning an activity.
- Performing poorly when having to complete something within certain time, even if the person knows what to do and there are no constrains.
- Having difficulties on interpret maps or diagrams quickly.

3.5.1.3.Why is processing speed important?

Processing speed is important as it provides an estimation of how efficiently an individual can perform basic, overlearned tasks or tasks that require processing of novel information (Holdnack, J et al. 2016). These tasks require a degree of ability of the individual to make a simple decision making. Performance on these tests reflects how well (speed and accuracy) the person can complete a specific procedure (e.g., simple math calculation, naming, visual identification, etc.), which can indicate the automaticity of that process, accessibility to that information, efficiency of information processing (e.g., visual or auditory discrimination), and speed of decision-making. (Holdnack, J et al. 2016). At the primary school level processing speed is important as it is related to learning abilities for acquiring math and language skills. At higher educational levels, students need processing speed for problem solving, subject – focused writing and complex reading. At midlife levels onwards, cognitive processing speed declines with age (Cerella J and Hale S, 1994) and lower processing speed seems to be the most important predictor of driving cessation in the elderly (Edwards JD, et al 2010). A person experiencing low processing speed is expected to have difficulties performing simple cognitive tasks fluently and automatically (Beal, A. L., et al 2016).

3.5.1.4. Processing speed ability and seniors

Cognitive processing speed is defined in the literature as the ability to process information rapidly, it is closely related to the ability to perform higher-order cognitive tasks (Lichtenberger and Kaufman, 2012) and is often assumed to be the core cause of deficits in performance on complex cognitive measures in aging population (Salthouse, 1996; Salthouse and Ferrer-Caja, 2003).

According to our study in this project almost 50% of seniors ages 55+ mention that they face difficulties related to their processing speed skills. For example, they face difficulties related to calculating their bills, reacting and adapting to new environments, solving simple problems in their head, understanding maps and diagrams, etc.

It is possible to improve cognitive processing speed. Neuroscience is studying brain plasticity and has shown that **the more we use neural circuits, the stronger they will become**, which is applicable to processing speed as well. Thanks to brain plasticity, the brain is able to change its structure and function. Brain plasticity allows us to create new brain connections and increase the amount of neural circuits, thus improving our ability to perform complex functions. The key to improving processing speed is making more solid connections in the brain, which allows the signals to travel faster from one end to the other and transfer the information faster. Although most of these connections are created in childhood, it has been proved that practice and training help maintaining and even improving our brain's processing s peed (CogniFit).

Anxiety can affect processing speed as we may need to take longer time to respond and make decisions. Vice versa, low processing speed can also create feelings of anxiety and low self-esteem. When people with slow processing speed are experiencing things in their environment, they need more time to process the information and feel more overloaded comparing to other individuals who do not face such those difficulties.

3.5.1.5.Intervention suggestions related to Processing Speed - Analysis of current 2D/3D games (apps) – (see also IO2-A2)

One way to train for processing speed is by using online existing applications for training or assessment of the Processing Speed skill. Examples of such applications are given below:

CogniFit [1]: The application will test the Processing Speed ability of the user and after the assessment will provide him/her with personalized training material.

CogniFit will help the user perform a complete neurocognitive assessment in which will assess his processing speed, and based on those results, will provide the user with a complete set of personalized cognitive activities to improve his/her cognitive processing speed.

The application was designed by a team of neurologists and cognitive psychologists who study the processes of synaptic plasticity and neurogenesis. According to the site, the user needs only 15 minutes a day, 2-3 times a week to stimulate his cognitive abilities and cognitive processes.

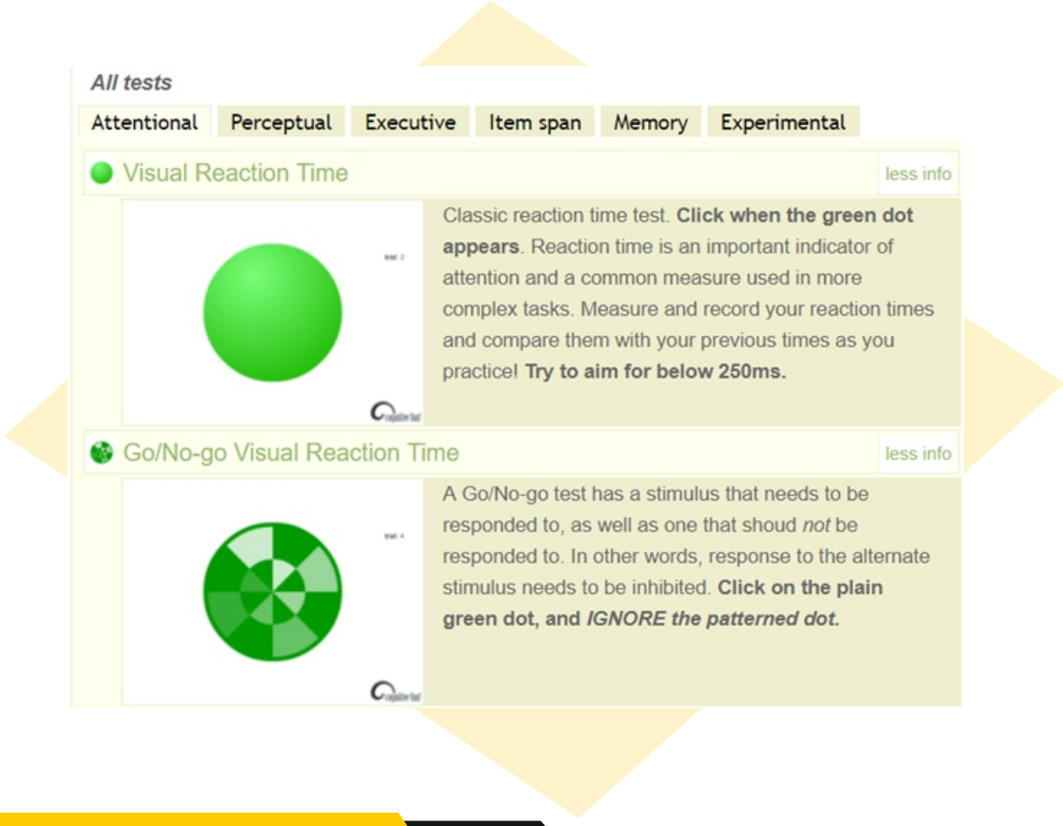
CogniFit can be found in different languages (e.g., Greek, English, French, Turkish, etc.), at https://www.cognifit.com/ .

The Stroop test [2]: The Stroop test is a very well-known measure of executive function. Its premise is straightforward:

a series of color words are presented to the test taker (i.e., “red," “blue," etc.), but the words themselves are printed in randomly colored ink. The task is to select the color of the word as fast as possible rather than selecting the word itself. So, if the word “red" were in blue ink, the test taker would answer “blue."

It turns out this is a pretty difficult thing for us to do. There are a few different theories out there for why this happens, but the main one is that the brain processes linguistic information far faster than colour information. Both the word and the colour hit our eyeballs at the same time, but the word gets pulled into the decision-making process first. The brain has to inhibit this information in order to select the correct, colour-based response. (Stroop, J.R. ,1935, MacLeod, C. M., 1991)

The Cognitive Fun website [3]. It has different applications for assessing the cognitive skills of a person; tests for at tention, perception, speed processing, item span and memory.



Lumosity Brain Training

Lumosity is a free app, designed by scientists and designers, which features games designed to improve memory, cognitive abilities, and problem-solving skills, through a daily mental training program.

Fit Brains Trainer

The Fit Brains Trainer offers balanced cognitive stimulation across 6 major brain areas, Focus, Memory, Speed, Logic, Visual and Language. Fit Brains family consists of dozen specialized iOS and Android apps, like Logic Trainer, Cognitive Assessment, and Focus Trainer
More games for the brain can be found at: https://www.gamesforthebrain.com/

Understanding more older adults by "Xtreme aging - senior sensitivity" program

The "Xtreme Aging" Program by the Macklin Intergenerational Institute uses simulated trainings where participants literally "feel" what it's like to age. Simulated exercises of what it may feel like to be an older adult are used such as: such as stuffing cotton in ears and putting rubber bands around hands to simulate arthritic symptoms and then being asked to complete simple tasks such as finding a phone number in a directory.
Most participants of the "Xtreme Aging" Program are surprised with the level of difficulty they have in completing simple tasks and end up with a much greater appreciation for what elderly go through.
You can find more information in the link below: http://www.programsforelderly.com/awareness-xtreme-aging-simulation.php

3.5.1.6.Trainer instructions

3.5.1.7.Learning objectives

- Improve the processing speed when performing basic arithmetic operations
- Decreasing the time required to complete tasks or assignments
- Be able to finishing tests and exams within allocated time
- Finishing a copying activity within allocated time
- Reading fast
- Being able to complete tasks under pressure with good processing speed
- Coming to the right answer, by spending less time

3.5.1.8.Teaching strategies

- Interactive 2D/3D games, focusing on specific or combination of skills
- Stimulating processing speed with game content/scenarios for quick decision making
- Applying right amount of stress on cognitive functions for measurable progress via enforcing time limitation
- or increasing difficulty
- Rewarding the improvement to build motivation and continuity
- Simple design with high contrast for easy understanding and accessibility

3.5.1.9. Assessment

- Assessment through the pre-defined difficulty levels in the game. Higher level will correspond to a
- higher cognitive ability.
- Additional assessment exercises through the learning platform at https://elearning.games4seniors.eu .

3.5.1.10.“Lava Trip” Game (implemented in context of TBC4Seniors project - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258)

The “Lava Trip” game addresses the exercising of “Processing Speed” skills. When entering the game, the player has the option to Play or Exit, also seeing information about the higher score achieved that far (see below screenshot).

After starting the game, the player will see blocks moving from the top of the screen to the bottom. The right part of the screen is visualising a volcano lava area, whereas the left part of the screen visualises a water area.There are also two types of blocks, each one corresponding to the left or right part of the screen. The player is expected to use his/her fingers and drag the blocks to the correct side. The classified blocks disappear. As the game moves, the level increases, with blocks coming in different speeds, and also mixing between the two types of blocks, etc. See the screenshots below:

The score starts from zero and increases with time. The longer the player survives in the game, the higher the score will be. At the beginning of the game, the player has a number of blocks at his/her disposal. The successfully classified blocks add to that number. The wrong classifications remove from that number. Also, if blocks hit each other when they are dragged, the number of blocks is reduced. The moment the number of blocks the player has hits zero, the game stops.

3.5.1.11.Training Strategies of the Game

- Interactive 3D game, focusing on the “Speed Processing” skill, however combining the “visual perception” and the “attention” skills.
- Stimulation of the processing speed through the game play; quick decision making, depending on the type of block and speed of the game.
- Applying right amount of stress on the processing speed cognitive function via enforcing increasing difficulty
- Rewarding the improvement to build motivation and continuity

3.5.1.12.Innovation of the “Lava Trip” game

- Designed, further to thorough research on the “Processing Speed” cognitive skill, as well as on the rest of the cognitive skills addressed by the project.
- Selection of simple shapes, sounds and colours, to maintain good contrast for easy understanding and accessibility.
- Appropriate selection of levels for the targeted users group.
- Adoption of common design specifications, agreed within the project for all games addressing the cognitive skills, so as to give to players the feeling of consistency and make them feel safe when moving through the games. This increases the success expectations of the games in addressing the targeted cognitive skills.

3.6.Sequential processing

1.1.1.Learning material related to “Sequential Processing”

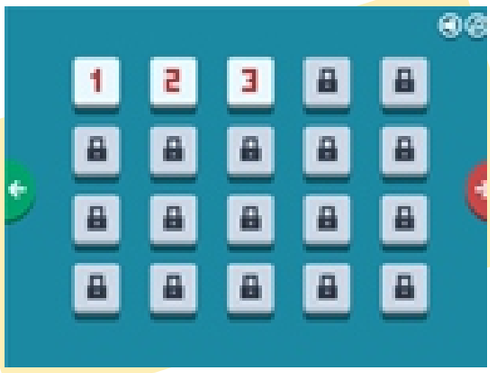
Sequential processing in the context of this project is related to the person's ability to arrange information and actions in an effective certain order. Sequencing issues can affect a person's ability to follow instructions, speak properly and complete multi-step tasks, such as setting up a dinner table, taking shower, playing a game, etc. This chapter aims to define the learning objectives of the senior-focused sequential processing games that are produced as an output of the project “Tablet Based Cognitive Gaming Platform for Seniors”.

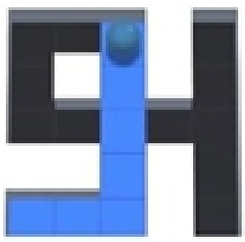
How is sequential processing affected by aging? As it is for anybody else when aging a decline in performance and functional problems frequently happens, and memory problems together with sequential processing are a "normal age effect" on the different psychological and body functions (Doron & Parrot, 2001).

Aging people can be checked regarding problems with sequential processing by a doctor/professional in the field (e.g. Ophthalmologist), after the person or family members recognize a lack of ability to complete simple daily tasks or even problems with speech.

3.6.3.3. Sequence

Before the users start playing there will be a “How to Play” display to help them through it. The game will consist of different phases that start from easy to difficult, stimulating the user to keep playing and challenging himself/herself. The user has to put items in a logical order. S/he can replay the phase if s/he gets it wrong. Phrases to stimulate the user to keep playing will be shown during every phase. After all levels the user will get an overall feedback about their points through the game.





Before the users start playing there will be a “How to Play” display to help them through it. The game will consist of different phases that start from easy to difficult, stimulating the user to keep playing and challenging himself/herself. The user has to use his/her finger to find the best way to fill up the maze path. S/he can replay the phase if s/he gets it wrong. Phrases to stimulate the user to keep playing will be shown during every phase. After all levels the user will get an overall feedback about their points through the game.

3.6.3.4. Assessment

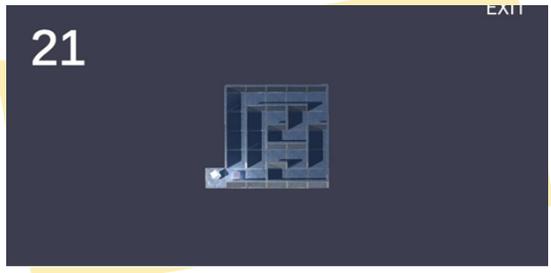
- The users' performance will be assessed by the level of ability to complete the different levels in the game, if he/she is able to pass the levels there will be a score given at the end of each phase.
- If the user cannot pass the basic and medium levels, s/he will be advised to try once again – “Not bad, try again”.
- If the user can keep passing the levels, s/he will be stimulated by rewarding image.

1.1.1.Learning Objectives:

- To improve sequential processing and related cognitive capacity by mental exercise on a tablet game platform, that might help improve or prevent problems in this area
- To improve the stimulation in the area of sequential processing by repetition and exercises via game-based learning
- To provide gradual and measurable improvement of the sequential processing capacity with escalating difficulty levels of exercises, accommodated in the game
- To make sure even the people with lowest sequential processing level can play and show progress, via a simple and intuitive design and interface
- To improve concentration and attention to utilize sequential processing better
- To enhance power of recognition of objects

To enhance the overall cognitive skills to improve the overall quality of life of elderly person.

3.6.5.Implemented game in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Dice Maze



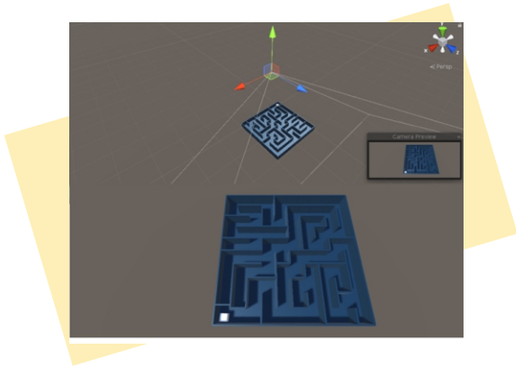
3.6.6.Teaching Strategies of the Game:

Before the users start playing there will be a “How to Play” display to help them through it. It is a game of 28 cards (hearts, diamonds, spades, and clubs) into the shape of a pyramid. It should be stacked so that the rows are made of one card, then two cards, then three cards, etc. until all the 28 cards have been placed in the pyramid and the user wins the game. The user will have the option to play with less cards, using only 2 (e.g. only hearts and spades). This game has the goal to help maintain the brain stimulation of the sequential processing functions.

3.6.7.Innovation of the game implemented in context of TBC4 Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258

The game was developed in Unity 3D environment.

- The game gradually increases the complexity level, yet has a range of levels allowing gradual increase of challenge for the player.
- Game specifically embraces contrast levels needed for the target users.
- Swipe gestures are trained and repeated in a gamified mode.
- Spatial dimensions are accentuated.
- Visual orientations are stimulated.



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I01 Connitive skills based training scheme for seniors

Tablet-Based Cognitive Gaming Platform for seniors

IO1 Prepare cognitive skills learning objects according to the need analysis survey

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TURKISH NATIONAL AGENCY

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DIŞİŞLERİ BAKANLIĞI
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PEPUBLIC OF TURKEY
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE FOR EU AFFAIRS

Co-funded by the
Erasmus+ Programme
Of the European Union

Training Program

Introduction

TÜRKİYE ULUSAL AJANSI
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Aims and objectives

The project aims to develop a **tablet-based cognitive gaming platform for older people to use either individually or in groups**. It will encourage the **use of multiple cognitive strategies** and difficulty of games will increase as performance improves.

A tablet-based gaming platform will be developed **to deliver cognitive stimulation in the form of a training program**, which aims to increase general cognitive and social functions.

The developed games and training program will enable older people **to experience group activities** using games running on a tablet and designed to enhance memory, attention, reasoning & planning, processing speed and sequential processing skills.

Challenges addressed

Research conducted by the project across all partner countries showed that there is no formal and consistent adult education framework in partner countries and adult education is basically included in the general education system of each country. Moreover, research findings underlined that already existing cognitive training entities are more likely private or driven by NGOs and do not have proper governemental or European support.

The survey showed that regardless of country, age or sex, there is a real need for improving cognitive and social function among older people. It concerns not only people already facing difficulties with cognitive skills but it also caters for prevention means.

Explanation of the blended approach

Nowadays, it is more and more common that seniors are familiar with using the internet and smartphones; it seems that the most suitable training delivery method would be a blended one, which combines both ***face-to-face*** and ***online*** training.

The two delivery methods work perfectly well together, as the face-to-face session could allow learners to be fully supported to work with new technologies.

List of general competences for trainer/carer

The role of the trainer/carer is to help older people by explaining the objectives of the project and of the training content, by using the games and by providing them constant human and technical support.

List of General Competences

- Communication skills
- Basic IT skills
- Relationships / interpersonal skills
- Teaching and pedagogical skills
- Dealing with diversity of profiles
- Humour and patience
- Problem solving
- Intercultural skills

Recommendations for trainers/carers

Teaching Principles

•Do not overload learners with theoretical content and presentations
•Allow ample opportunities for learners to ask questions and to provide feedback
•Be flexible
•Respect the past experiences of the learners
•Practice active listening
•Speak clearly
•Keep the motivation high
•Summarise and recap at the end of each session

Training scheme

TÜRKİYE ULUSAL AJANSI
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AVRUPA BİRLİĞİ BAŞKANLIĞI
PEPUBLIC OF TURKEY
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE FOR EU AFFAIRS

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Recommendations for trainers/carers

The present document is a **handbook** dedicated to trainers and carers in order to successfully implement the games with older people and help them to use the games independently.

Each game contains:

•**Introduction** gathering presentation and objectives of the game, which training needs it addresses, what are the needed skills (e.g., required basic IT skills, no skills required, etc.)
•**Toolkit:** required material (e.g., ICT device, Internet connection, stylus, etc.), rules of the game with pictures or videos, recommendations on duration, assessment methods.

Preparatory steps required

•**Each trainer/carer should be familiar with the games** and be able to clearly explain the objectives and rules of the games
•Make sure that there are **available devices** (smartphones and tablets) and reliable Internet connection
•Set-up a proper **learning environment** for concentration
•**Prepare ice-breaking questions** to install trust and good mood between participant(s)
•**Preparing introductory game**: not necessarily an online game; each trainer is up to choose the best game according to the audience (ex: quiz on general knowledge)
•**Prepare a description and explanation of the game**

Action Plan

Before the training:
•Preparation of the training's programme and content according to the chosen cognitive games' topic
•Recruitment of the participants
•Logistical preparation of the training: ICT requirements, location, catering

During the training:
•Presentation of the project and training's objectives (10 min)
•Ice-breaking activities//questions: to built a trust and good relation with trainer/carer, plus getting to know each other (15 min)
•Introductory game (20 min)
•Short break (15 min)
•Description and explanation of the cognitive games (according to the chosen topic): rules of the games with a quick demo including pictures or videos, explanation of the assessment (10 min)
•Training (30 min)
•Recommendations on the duration (5 min)
•Conclusion, general discussion, reflection and feedback (15 min)

Templates of games

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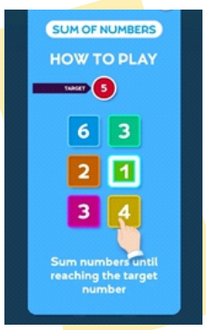
Introduction - Analysis of current 2D/3D apps

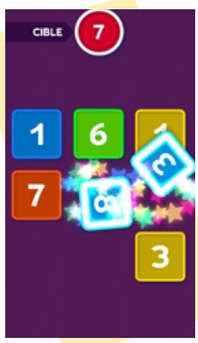
•**Name of the game:** *Sum of numbers*
•**Main objectives:** Improving processes of logic, strategic planning, problem solving and deductive reasoning and calculation skills
•**Training needs addressed**: helping with solving simple problems issues, reinforcing speed calculation
•**Needed skills:** no particular skills needed, just resolving simple maths problems in their head sequentially

Toolkit

•**Materials needed :** smartphone or tablet with an Android system, Internet connection
•**Rules on how to play the game with explanations and pictures or videos**

1) Add up numbers until the target number is reached
2) The target number to reach appears on the top of the screen and a selection of numbers are available below. You have to click on numbers which will indicate the sum of the target number above. Those numbers will disappear and the target number will change afterwards. This task will be repeated until all numbers disappear.
3) The level of difficulty increases at each level





Toolkit

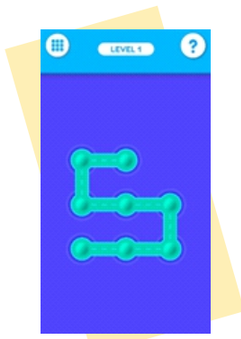
•**Recommendations on duration**: at least 3 times per week, during a 2 month period. Each session should last 15-20 minutes.
•**Assessment**: The user will be assessed by the levels in the game. The game will start with the easiest first level and as long as the user passes this level, more levels will be unlocked. Higher level will correspond to a higher cognitive ability.

Introduction - Analysis of current 2D/3D apps

•**Name of the game:** *One line*
•**Main objectives:** training logic reasoning and strategic planning and defining an appropiate strategy to reach the solution.
•**Training needs addressed**: helping with planning things and moves to define a strategy to reach a desired outcome
•**Needed skills:** being able to keep the finger on the screen for a while

Toolkit

•**Materials needed :** smartphone or tablet with an Android system, Internet connection
•**Rules on how to play the game with explanations and pictures or videos:**
1) Fill in all of the blocks by drawing only One line.
2) You will have to mark all the block with one line with your finger on a touch screen.
3) The idea is to start from one point and keep slipping the line through all the points without interrupting or going twice thorough the same point
4) You will be starting from the Level 1 and since you move forward with first level, more levels will be unlocked.



Toolkit

•**Recommendations on duration**: at least 3 times per week, during a 2-month period. Each session should last 15-20 minutes.
•**Assessment**: The user will be assessed by the levels in the game. The game will start with the easiest first level and as long as the user passes this level, more levels will be unlocked. Higher level will correspond to a higher cognitive ability.

•**Name of the game:** *Tower of Rings*

the right moves to reach the solution in the shortest possible time

•**Training needs addressed**: helping with problem-solving and logical planning

•**Needed skills:** no particular skills needed

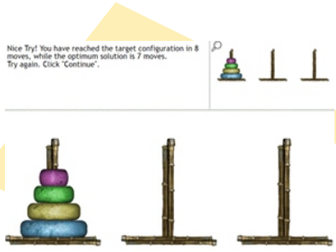
•**Materials needed :** smartphone or tablet with an Android system, Internet connection

•**Rules on how to play the game with explanations and pictures or videos:**

1) Rebuild the tower of rings by making strategic moves

2) Configure colored rings on a series of pegs in order to match a target. Possibility to move the top-most ring on each peg to another peg, but you can only move one ring at a time and you can never put a larger ring on top of a smaller ring

3) It should be completed in a certain number of moves. You have to play it in a defined time within a defined number of attempts to achieve the solution



Toolkit

•**Recommendations on duration**: at least 2 times per week, during a 2-month period. Each session should last 20 minutes.

•**Assessment:** The user is assessed through the limited time for reaching the solution and the number of attempts. Then, he/she could go to the next level.

Introduction - Analysis of current 2D/3D apps

•**Name of the game:** ***Piko's Cube***

•**Main objectives:** strengthening logic reasoning capacities by making strategic moves and reproducing the pattern with the less attempt as possible

•**Training needs addressed**: helping with logic reasoning and planning

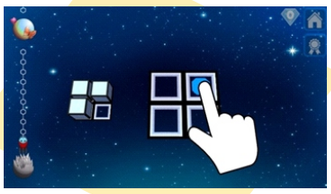
•**Needed skills:** no particular skills needed

Toolkit

•**Materials needed :** smartphone or tablet with an Android system, Internet connection

•**Rules on how to play the game with explanations and pictures or videos:**

1) Choose the language you prefer for your game and click on play
2) There are two sides on the screen: figure already that is to be reproduced and the blank space where you should recreate the same figure with your cubes by touching the screen
3) The patterns will get harder as you successfully advance with each figure
4) Cubes will be shown in 3D version with several layers sometimes
5) You will be starting from the Level 1 and since you move forward with first level, more levels will be unlocked.



Toolkit

•**Recommendations on duration**: at least 2 times per week, during a 2-month period. Each session should last 15 minutes.

•**Assessment:** The user is assessed through the stars shown after each level by his/her capacity to reach the solution and to use the less number of attempts. Then, he/she could go to the next level.

Implemented game in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Fit the box

Introduction

•**Name of the game:** ***Roll the Cube***

•**Main objectives:** strengthening logic thinking, reasoning capacities by planning the moves and reproducing the pattern with the less attempt as possible

•**Training needs addressed**: helping with logic reasoning and planning

•**Needed skills:** no particular skills needed

Implemented game in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Fit the box

Toolkit

•**Materials needed :** smartphone or tablet with an Android system, Internet connection

•**Rules on how to play the game with explanations and pictures or videos:**

1) There is a figure shown represented with blue cubes.

2) The person needs to “catch” (with their finger) a red cubes’ available and place them in order to achieve the same pattern that is shown with blue cubes.

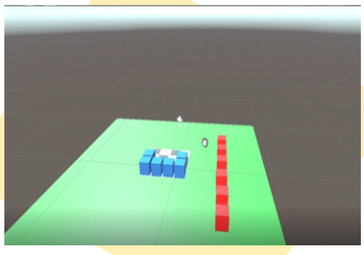
3) Once the pattern is reproduced successfully, the level gets harder and the pattern changes accordingly.

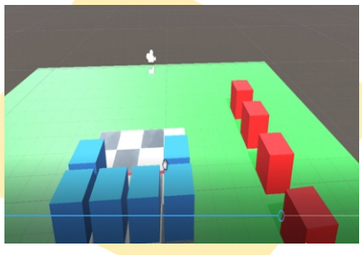
Implemented game in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258: Fit the box

Toolkit

•**Recommendations on duration**: at least 2 times per week, during a 2-month period. Each session should last 15 minutes.

•**Assessment:** The user is assessed through the limited time for reaching the solution and the number of attempts. Then, he/she could go to the next level.





Innovation of the game implemented in context of TBC4Seniors - Tablet-Based Cognitive Games for Seniors - 2018-1-TR01-KA204-058258

•Contrast colors blue and red to be differentiate easily by older persons
•Big cubes sizes for vision perception of seniors
•Difficulty level is integrated in the game and automatically changes once the previous level is completed successfully.
•Easy and efficient way to stimulate reasoning ability by planning each strategic move in order to achieve required result.
•Rotation background allow to see the picture and the volume of the cube from different perspective

Memory games

Introduction

•**Name of the game:** Tile Game

•**Main objectives:** This classic game focuses on the spatial memory (remembering the location of things). Main learning objectives are:

•To improve memory and related cognitive capacity via mental exercises on a tablet game platform.

•To enhance mnemonics through retrieval of semantic items and images.

•To improve memory muscles through repetition and exercises.

•To provide gradual and measurable improvement of the memory capacity with escalating difficulty levels of exercises.

•To make sure even the people with lowest memory level can play and show progress, via offering simple and intuitive design and interface.

•Improve concentration and attention to utilize memory better

•To enhance power of recognition

•Hence, enhance the overall cognitive skills to improve the quality of life of elderly person.

Introduction

•**Training needs addressed:** Assistance on downloading game and demonstration of game tutorial may be required by player.

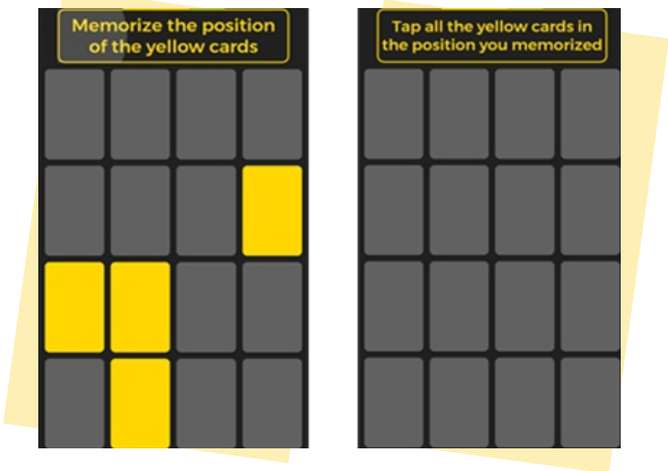
•**Needed skills:** Basic smart phone or tablet navigation a skills and knowledge. Familarity with touch screen interfaces and interaction.

Memory games

Toolkit

•**Materials needed:** A tablet or smart phone with internet connection.

•**Rules on how to play the game with explanations and pictures or videos:** Tile game highlights a few tiles (generally around 20-40 % of the tiles), then asks which of those tiles were highlighted. It starts from 2x2 or 3x3 and builds up to higher number of boxes and more complex highlighted box variations. Difficulty is arranged by number of tiles highlighted and total number of tiles on screen.



Toolkit

Rules:

•Wait for boxes to be highlighted.

•Once they are highlighted player has a short period of time to record the location of boxes' to his/her memory.

•Highlights are removed and player need to click the previously highlighted boxes by recalling their location from their memory.

•If player fails, he/she repeats the game in the same difficulty level till he/she advances his/her memory.

•If player succeeds (by clicking right boxes without mistake) moves to a slightly more difficult game level to give challange.

Memory games

Toolkit

•**Recommendations on duration:** At least 20 minutes a day, minimum 4 days a week for 4 weeks.

•**Assessment:** The player can assess himself/herself by the difficulty level in the game. The game will start with the easiest level and advance to more difficult and complex levels. Higher level will correspond to a higher memory efficiency. Player (or trainer) should record the highest difficulty level that player can achieve in first 20 minutes and compare it with the highest achieved level at the end of the designated period of time.

Introduction

•**Name of the game:** Picture Matching

•**Main objectives:** This classic game focuses on the visual memory. Main learning objectives are:

•To improve memory and related cognitive capacity via mental exercises on a tablet game platform.

•To enhance mnemonics through retrieval of semantic items and images.

•To improve memory muscles through repetition and exercises.

•To provide gradual and measurable improvement of the memory capacity with escalating difficulty levels of exercises.

•To make sure even the people with lowest memory level can play and show progress, via offering simple and intuitive design and interface.

•Improve concentration and attention to utilize memory better

•To enhance power of recognition

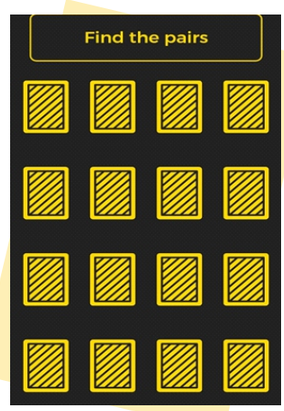
•Hence, enhance the overall cognitive skills to improve the quality of life of elderly person.

•**Training needs addressed:** Assistance on downloading game and demonstration of game tutorial may be required by player.

•**Needed skills:** Basic smart phone or tablet navigation a skills and knowledge. Familarity with touch screen interfaces and interaction.

-**Materials needed:** A tablet or smart phone with internet connection.

-**Rules on how to play the game with explanations and pictures or videos:** Similar to tiles game, but this time, all tiles are shown and each tile has an image, however each image is repeated twice. Once the tiles are closed, player will be required to guess which 2 tiles hides the same pair of pictures.



Memory games

•**Toolkit**

•**Rules:**

•Try to memorize the location of each picture "pairs" on the screen.

•Once boxes are hidden, guess the location of each pair. You will have 2 clicks to find each pair.

•If player fails to find all pairs under certain number of trials, he/she repeats the game in the same difficulty level till he/she advances his/her memory.

•If player succeeds (by clicking right boxes within limited number of trials) moves to a slightly more difficult game level to give challange.

•**Recommendations on duration:** At least 20 minutes a day, minimum 4 days a week for 4 weeks.

•**Assessment:** The player can assess himself/herself by the difficulty level in the game. The game will start with the easiest level and advance to more difficult and complex levels. Higher level will correspond to a higher memory efficiency. Player (or trainer) should record the highest difficulty level that player can achieve in first 20 minutes and compare it with the highest achieved level at the end of the designated period of time.

•**Name of the game:** Repeat the Sequence

•**Main objectives:** This classic game focuses on the Episodic memory which involves remembering the incidental order of a series of events that comprise a specific experience. . Main learning objectives are:

•To improve memory and related cognitive capacity via mental exercises on a tablet game platform.

•To enhance mnemonics through retrieval of semantic items and images.

•To improve memory muscles through repetition and exercises.

•To provide gradual and measurable improvement of the memory capacity with escalating difficulty levels of exercises.

•To make sure even the people with lowest memory level can play and show progress, via offering simple and intuitive design and interface.

•Improve concentration and attention to utilize memory better

•To enhance power of recognition

•Hence, enhance the overall cognitive skills to improve the quality of life of elderly person.

-**Training needs addressed:** Assistance on downloading game and demonstration of game tutorial may be required by player.

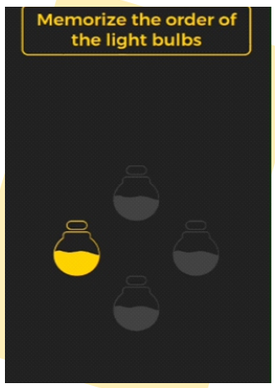
-**Needed skills:** Basic smart phone or tablet navigation a skills and knowledge. Familarity with touch screen interfaces and interaction.

Memory games

•**Toolkit**

•**Materials needed:** A tablet or smart phone with internet connection.

•**Rules on how to play the game with explanations and pictures or videos:** This game will focus on episodic memory to enhance remembering chronological order of things in daily life. Game will illuminate certain objects in confusing order and will ask user to repeat the sequence.



•**Rules:**

•Group of objects will be illuminated on the screen in random order.

•Try to remember the order the sequence of illumination order of the objects.

•Then repeat the order by touching / clicking on the objects in the same sequence.

• If player fails, he/she repeats the game in the same difficulty level till he/she advances his/her memory.

•If player succeeds moves to a slightly more difficult game level to give challange.

•**Recommendations on duration:** At least 20 minutes a day, minimum 4 days a week for 4 weeks.

•**Assessment:** The player can assess himself/herself by the difficulty level in the game. The game will start with the easiest level and advance to more difficult and complex levels. Higher level will correspond to a higher memory efficiency. Player (or trainer) should record the highest difficulty level that player can achieve in first 20 minutes and compare it with the highest achieved level at the end of the designated period of time.

Attention games

•**Introduction**
•Name of the game:
•Main objectives:
•Training needs addressed:
•Needed skills:

Toolkit

•Materials needed (ICT devices, Internet connection, stylus etc.)
•Rules on how to play the game with explanations and pictures or videos
•Recommendations on duration:
•Assessment:

1 Visual perception games

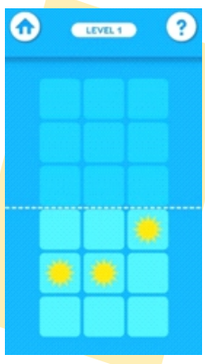
Introduction

•**Name of the game:** Matching Game
•**Main objectives**: provide gradual and measurable improvement of the visual perception capacity through the game with escalating difficulty levels
•**Training needs addressed:** visual perception stimulation to follow the matching objects
•**Needed skills:** no particular skills needed

Toolkit

•**Materials needed** (ICT devices, Internet connection, stylus etc.): smartphone or tablet with an Android system, Internet connection
•**Rules on how to play the game with explanations and pictures or videos:**

1. Pay attention on the bottom objects and how to connect them
2. Follow the pattern of matching the objects on the blank space
3. The level of difficulty increases at each level



1 Visual perception games

•**Introduction**

•**Name of the game:** Block Puzzle

•**Main objectives**: provide gradual and measurable improvement of the visual perception capacity through the game with escalating difficulty levels

•**Training needs addressed:** visual perception stimulation to follow the matching objects

•**Needed skills:** no particular skills needed

Toolkit

•**Materials needed** (ICT devices, Internet connection, stylus etc.): smartphone or tablet with an Android system, Internet connection

•**Rules on how to play the game with explanations and pictures or videos:**

1. Example of how to fit the figures in the shaded space

2. The level of difficulty increases at each level

2 Visual perception games

Toolkit

•**Recommendations on duration:** at least 3 times per week during 2 months. Each session should last 10 minutes.

•**Assessment:** The user will be assessed by the levels in the game. The game will start with the easiest first level and as long as the user passes this level, more levels will be unlocked. Higher level will correspond to a higher cognitive ability.

Processing Speed Games

Introduction – Game 1

•**Name of the game:** My day routine

•**Main objectives**: provide gradual and measurable improvement of the processing speed capacity, by interacting with the game environment and responding to gradually more complex challenges

•**Training needs addressed:** Improve the processing speed when performing certain everyday activities, decreasing the time required to complete tasks or assignments, reacting quickly to stimulus, being able to complete tasks under pressure with good processing speed, coming to the right answer, by spending less time

•**Needed skills:** no particular skills are pre-required

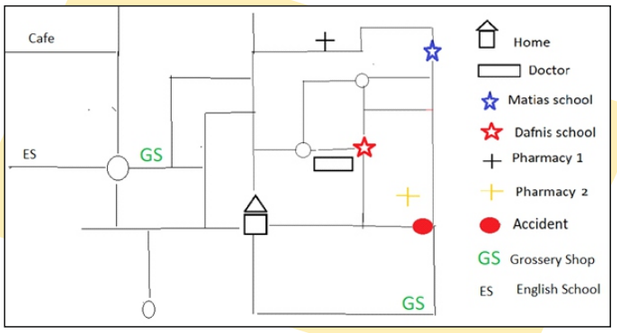
Toolkit

•**Materials needed** (ICT devices, Internet connection, stylus etc.): smartphone or tablet running an Android system

•**Rules on how to play the game with explanations and pictures or videos:**

The players will be presented with an environment where they will be challenged with activities like:

•Remembering to take their medication on time, Attending appointments (doctor appointments, taking the children from school the right time, taking each child to each activity at the right time), Cooking, Shopping, Calculating their bills, Taking different decisions such as “Going to the nearest or less expensive supermarket to buy shopping”



•**Toolkit**

•**Recommendations on duration:** at least 3 times per week during 2 months. Each session should last 15 minutes.

•**Assessment:** The player will be assessed through the pre-defined difficulty levels in the game. Higher level will correspond to a higher cognitive ability. Additional assessment exercises through the learning platform at https://elearning.games4seniors.eu .

Processing Speed Games

Introduction – Game 2

•**Name of the game:** Unlock my Day

•**Main objectives**: provide gradual and measurable improvement of the processing speed capacity, by interacting with the game environment and responding to gradually more complex challenges

•**Training needs addressed:** Improve the processing speed when performing certain everyday activities, decreasing the time required to complete tasks or assignments, reacting quickly to stimulus, being able to complete tasks under pressure with good processing speed, coming to the right answer, by spending less time

•**Needed skills:** no particular skills are pre-required

Toolkit

•**Materials needed** (ICT devices, Internet connection, stylus etc.): smartphone or tablet with an Android system

•- **Rules on how to play the game with explanations and pictures or videos:**

1. Inspired by the Doors and Rooms game (https://doorsandroomsguide.com/)

2. The user is presented with an environment (e.g., home, school, grocery shop, …) and needs to solve some "puzzles" quickly enough in order to unlock the next level

3. Time is a critical factor here, to exercise on processing speed

Toolkit

•**Recommendations on duration:** at least 3 times per week during 1 month. Each session should last about 1 hour.

•**Assessment:** The player will be assessed through the pre-defined difficulty levels in the game. Higher level will correspond to a higher cognitive ability. Additional assessment exercises through the learning platform at https://elearning.games4seniors.eu .

1 Sequential processing games

Introduction

•**Name of the game:** Sequence

•**Main objectives:** provide gradual and measurable improvement of the sequential processing of the user through the game with escalating difficulty levels

•**Training needs addressed:** sequential processing stimulation to follow the order of the objects in the game

•**Needed skills:** no particular skills needed

Toolkit

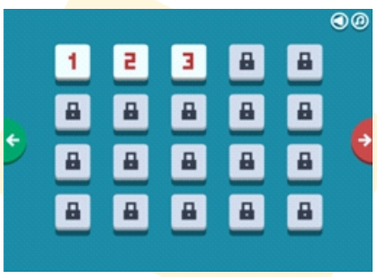
•**Materials needed (ICT devices, Internet connection, stylus etc.):** smartphone or tablet with an Android system, Internet connection

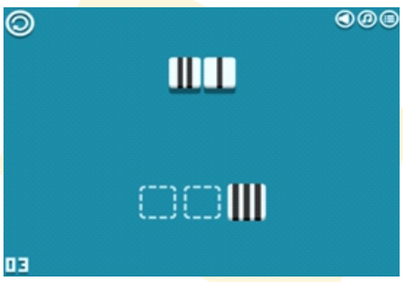
•**Rules on how to play the game with explanations and pictures or videos:**

1. Display how many levels are

2. Give an example of how to follow a sequency (that will change by levels)

3. The level of difficulty increases at each level





Toolkit

•**Recommendations on duration:** at least 4 times per week during 2 months. Each session should last 10 minutes.

•**Assessment:** The user will be assessed by the levels in the game. The game will start with the easiest first level and as long as the user passes this level, more levels will be unlocked. Higher level will correspond to a higher cognitive ability.

Introduction

•**Name of the game:** Maze

•**Main objectives:** provide gradual and measurable improvement of the sequential processing of the user through the game with escalating difficulty levels

•**Training needs addressed:** sequential processing stimulation to follow the order of the objects in the game

•**Needed skills:** no particular skills needed

1 Sequential processing games

Toolkit

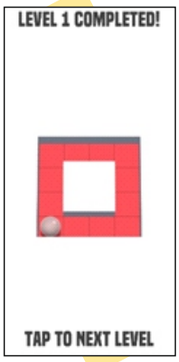
•**Materials needed (ICT devices, Internet connection, stylus etc.):** smartphone or tablet with an Android system, Internet connection

•**Rules on how to play the game with explanations and pictures or videos:**

•Give an example of how to visualise the maze and find the way out by painting the path

•Example of how to finalise the maze and then the game starts

•The level of difficulty increases at each level



Toolkit

•**Recommendations on duration:** at least 4 times per week during 2 months. Each session should last 10 minutes.

•**Assessment:** The user will be assessed by the levels in the game. The game will start with the easiest first level and as long as the user passes this level, more levels will be unlocked. Higher level will correspond to a higher cognitive ability.

Assessment and impact of the games

Possible approaches for assessing the use and impact of the games to be decided by each trainer/carer and partner:

1) Final focus group

2) Individual questionnaires

Suggestions of topics to be addressed:

•General level of satisfaction from the game (positive/negative)

•Frequency of use

•Duration of use

•Estimation of improvement of cognitive capacities

•Willingness to repeat a similar experience

•Evaluation of the training method

•General recommendations and comments