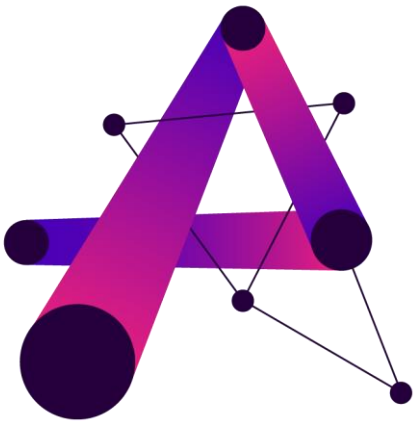
User Manual Kinisi

Version 1.0

06-05-2023



Authors

J. Muijsenberg	Scientific Lead	Aristotle Technologies
V. Reinders	CTO	Aristotle Technologies

Published 06-05-2023

Content

Chapter 1 What is Kinisi?

Kinisi is a cognitive training tool. In short, it is a software tool that includes evidence-backed tasks. Its goal is to improve the well-being of people by enhancing cognitive functioning. Kinisi is co-created in collaboration with professionals within the field of elite sports, physiotherapy, and psychology.

What is cognitive training? Cognitive training is an approach, using structured tasks, which aims to improve or maintain cognitive abilities [1]. These cognitive abilities vary and include functions such as memory, attention, and problem-solving [1]. Literature suggests that the effect of cognitive training is mediated by the neuroplasticity of the brain [1]. This so-called neuroplasticity is defined as “the ability of the nervous system to change its activity in response to intrinsic or extrinsic stimuli by reorganizing its structure, functions, or connections” [2].

The power of Kinisi lies in its combination training possibilities. This means Kinisi allows the combination of a cognitive exercise with motor training. For most daily activities simultaneous execution of cognitive and motor tasks is required [3]. It is assumed that combination training improves both isolated motor- and cognitive performance as well as dual-task abilities [4]. However, to achieve the most optimal training effect it is very important to individualize the training to its players. With Kinisi it is possible to adjust the physical task and additional cognitive load for every individual player. This way, the player trains in a goal-driven matter.

Chapter 2 Working with Kinisi

2.1 System Requirements

All devices that have an internet connection and have access to a browser are theoretically able to run the web-based version of Kinisi. The web-based version of Kinisi has been validated to work on Windows 10 and 11, MacOS and iPadOS, and Android tablets. It has been tested to work with Google Chrome, Firefox, Microsoft Edge, and Apple's Safari.

Logging in to the online tool and saving exercise data requires an internet connection. Performing an exercise does not require an internet connection. No internet connection thus leads to loss of data and the inability to analyze performances.

2.2 Download Kinisi Shortcut

It is possible to download Kinisi from the web-based version and add it as a shortcut on your desktop. Opening the shortcut on your desktop will still open the web app in your browser, but it will be visualized as an application. Note that you will still need an internet connection to log in and save data.

To download the shortcut on a Windows computer: type in the URL of the Kinisi tool for your organization in your browser. You will be greeted with the login page (Figure 1). The download button is located at the top right of the screen, illustrated in Figure 1. Depending on the browser, the top bar may differ from the one shown in Figure 1. Pressing this button will open a window asking you to confirm the installation. Press “install” to start the installation process. A shortcut is placed on your desktop for easy access.

Downloading the web-based application on another device, such as a tablet, is often possible by clicking the three dots visible at the top right of the screen when browsing the Kinisi web app URL. Based on your type of device a button “Add to Home” appears, after clicking the three dots.

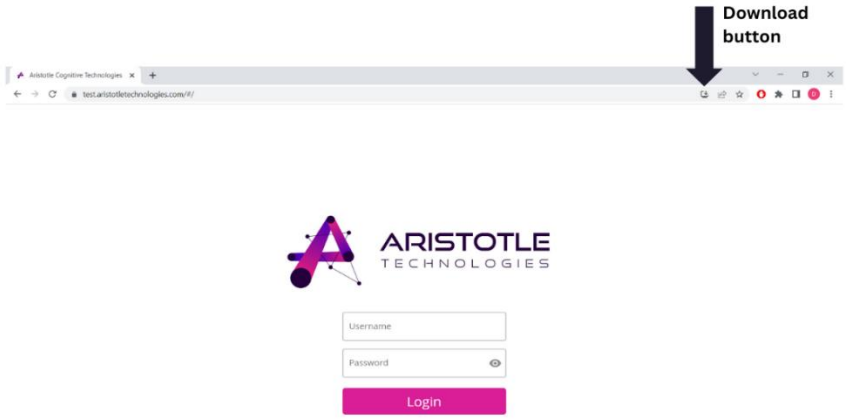


Figure 1: *Login page.*

2.3 New Versions of Kinisi

When using Kinisi, new updates are automatically installed upon launching Kinisi. Regardless of using a web browser or the downloaded shortcut to open the tool. Your system will always be up to date!

Chapter 3 Labelling of Pages

3.1 Login Page

Logging in is possible at the login page using the login credentials which are either provided via email, or directly via your contact person at Aristotle Technologies. For more information regarding the login credentials, please contact your contact person. The functionality of the login page is labeled in Figure 2.

1. Username
2. Password
3. Log in button

Figure 2: *Labelling of the login page.*

3.2 Exercises Page

The exercises page is the first page that appears after logging in (Figure 3). On the exercises page, it is possible to either navigate to other pages via the left-sided bar or start an exercise. Be aware that depending on the number of exercises it is possible to scroll down on the exercises page.

1. Exercises page button
2. Team/player page button
3. Settings page button
4. Data download button
5. Log out button
6. Information button
7. Start button for the corresponding task

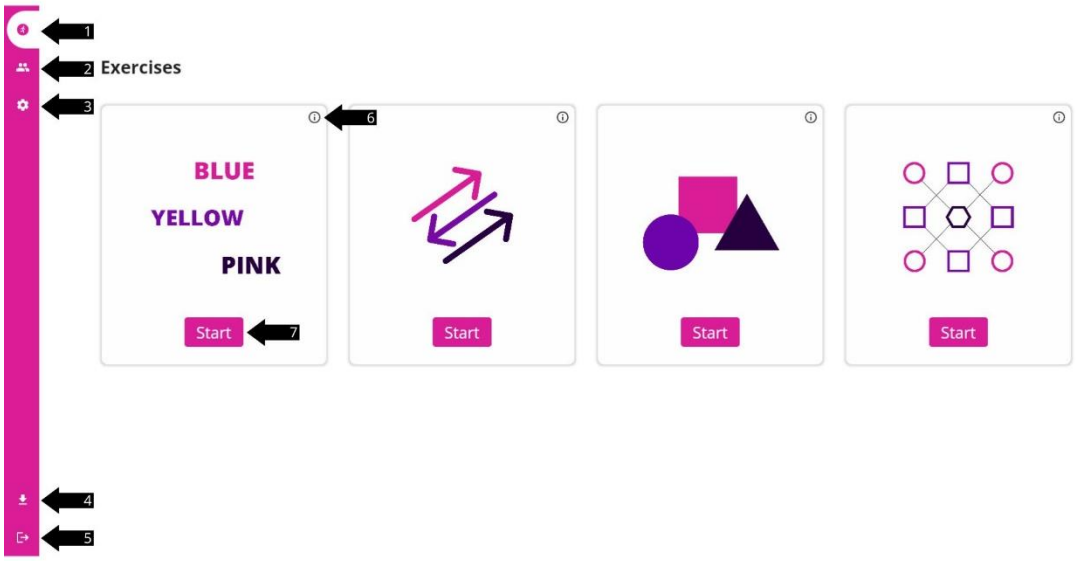


Figure 3: *Exercises page.*

Clicking on the start button of a task reveals the settings page of the chosen task. Figure 4 shows an example of what the settings page of a specific task looks like. More information about these options can be found in Chapter 5.3.

1. Duration
2. Interval
3. Levels
4. Language
5. Fixation point
6. Add a team or player
7. Start the task

Figure 4: *Settings page for a specific task (Modified Stroop Task used as an example).*

3.3 Feedback Page

When finishing an exercise, the following page appears (Figure 5). This page shows several outcome parameters of the finished exercise.

1. Data point
2. Mean
3. Y-axis – Reaction time
4. X-axis – Stimuli
5. Task difficulty (entered by the supervisor in case necessary)
6. Player performance (entered by the supervisor in case necessary)
7. Comment box (entered by the supervisor in case necessary)
8. Total score
9. Percentage correct
10. Percentage consistency
11. The mean duration of correct answers
12. Overall mean duration
13. The mean duration of incorrect answers
14. Settings of the current task
15. Start a new exercise for the current task
16. Go back to the exercises page

Figure 5: *Feedback page.*

3.4 Players Page

On the players page (Figure 6) it is possible to create, update and delete teams and players. Note that data will only be saved if you add a team and player when performing an exercise.

1. Options for an existing team
2. Edit the team name
3. Delete the team
4. Add a new team
5. Search within the existing players
6. Add a new player
7. Edit an existing player (or delete it within the editing window)

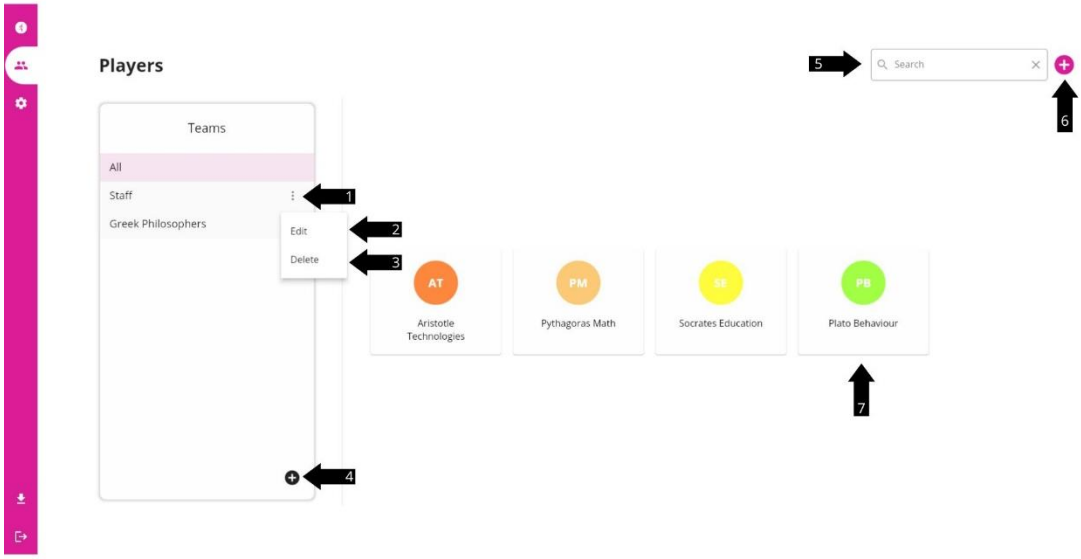


Figure 6: *Players page.*

On the following page, it is possible to add a new team (Figure 7).

1. Add team name
2. Save team

Figure 7: *Add a new team.*

If a team still contains players and you want to delete this team the following page will appear (Figure 8). On this page, you first have to delete the players or reallocate the players to a different team to be able to delete this team.

1. Delete the player
2. Relabel the team for this player
3. Accept the changes and delete the team

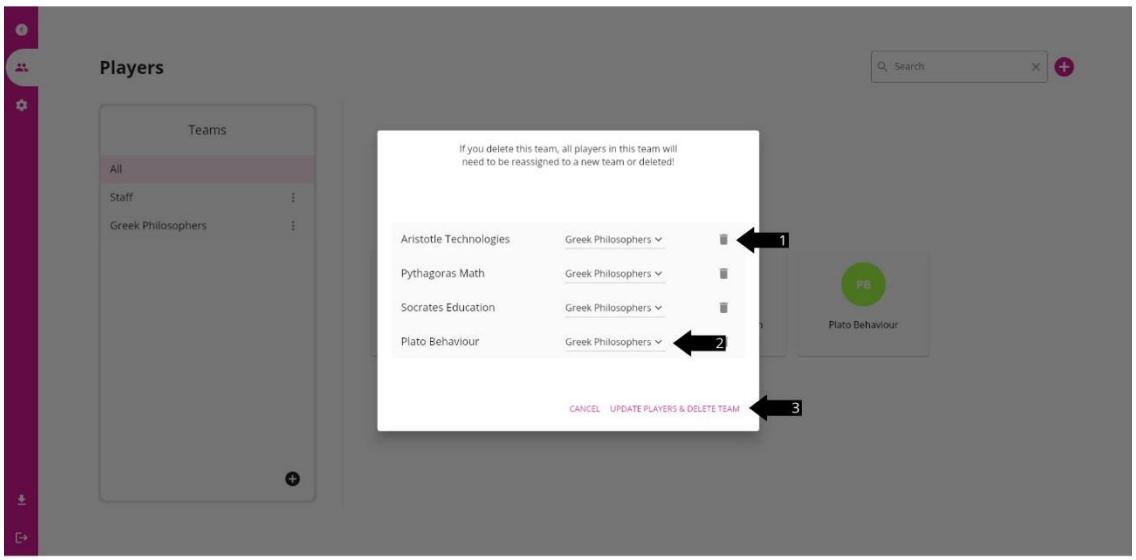


Figure 8: *Screen on deleting a team that still contains players.*

On the following page, it is possible to add a new player (Figure 9).

1. Enter username
2. Enter first name
3. Enter last name
4. Choose a team for the new player
5. Save the new player

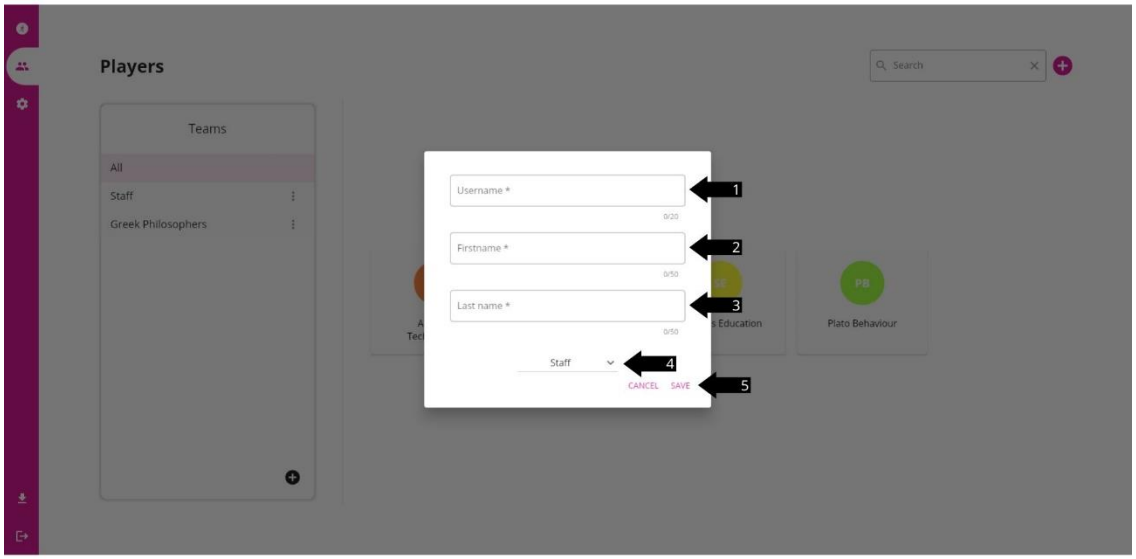


Figure 9: *Add a new player.*

On the following page, it is possible to edit or delete an existing player (Figure 10). Other labeling matches the labels when adding a new player as explained before.

1. Delete the player

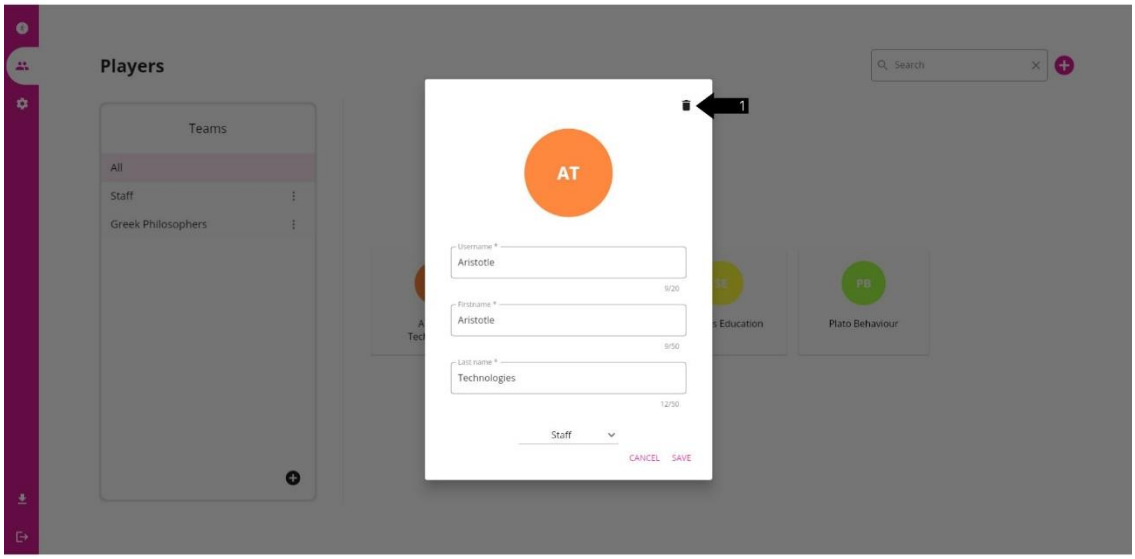


Figure 10: *Edit an existing player.*

3.5 Settings Page

On the settings page, it is possible to alter your personal information (Figure 11).

1. First name
2. Last name
3. Email address
4. Save the user settings
5. More information regarding licenses and versions of the application

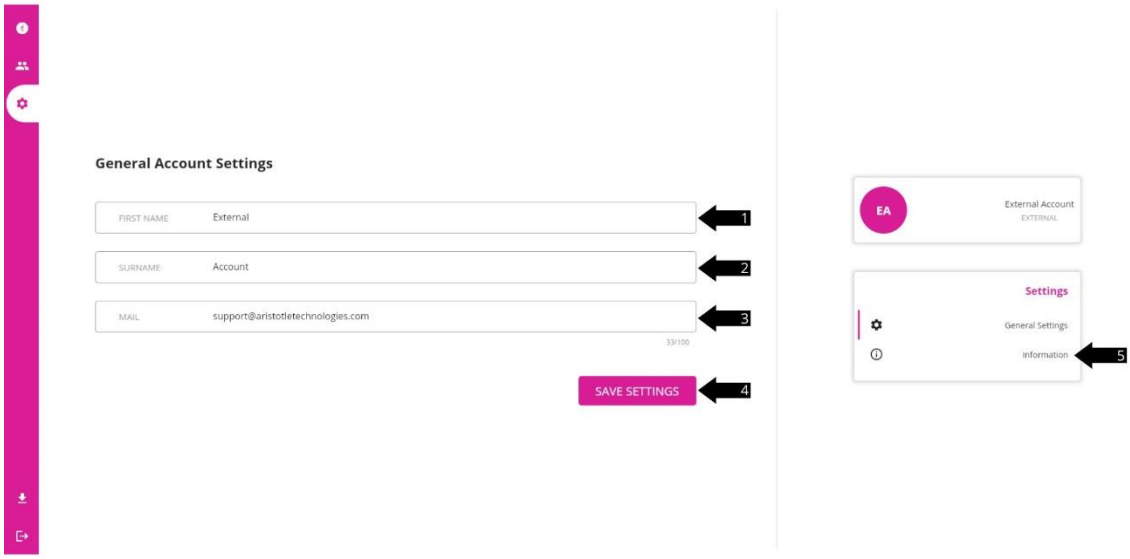


Figure 11: *Settings page.*

Chapter 4 Supported Controllers

4.1 Keyboard Controls

In general, navigation through Kinisi is possible using your cursor. When starting an exercise, the instructions will inform you which keys are used for that specific task. Make sure to pay attention to these instructions. Regardless of the task, it is always possible to use the arrow keys of your device to give input. The spacebar is used to pause an exercise. After pausing the exercise, you can choose to resume or quit the ongoing exercise.

4.2 Bluetooth Controller

Aristotle Technologies offers the use of the 8BitDo Zero 2 Bluetooth controller by the client organization. For the 8BitDo Zero 2 controller Aristotle Technologies provides support. If an organization uses a different Bluetooth controller, they most likely need to use a key mapper which complicates the usage of Kinisi.

Figure 12: 8BitDo Zero 2 controller

If you want to connect the 8BitDo Zero 2 controller, follow the next steps:

1. Turn on Bluetooth on your device.
2. On the controller, press **R** & **start** to turn on the controller. The blue LED blinks 5 times per cycle.
3. Press **select** for 3 seconds to enter its pairing mode. The LED starts to rapidly blink.
4. On your device, pair with '8BitDo Zero 2 gamepad'. The blue LED becomes solid when the connection is successful.
5. The controller will auto-reconnect to your device with the press of start once it has been paired.

Chapter 5 Tasks

5.1 General Background Information

Kinisi includes various cognitive tasks focusing on several domains of cognition. In the following paragraphs, the functionalities of starting and completing exercises are explained. As well as the cognitive background of every task and level.

5.2 Tasks

5.2.1 Modified Stroop Task

Main task: A word will appear. The word is filled with a specific color. The question is whether the word matches the color in which the word is written. If the color of the word and the word itself are congruent (match), press the left button. If the color of the word and the word are incongruent (do not match), press the right button.

Levels	**Added cognitive ability**
Level 1	*Main task*
Level 2	*Peripheral vision*: In level 2 of the Modified Stroop Task, the words appear at different locations. Make sure your eye fixation is in the middle of the screen. It is possible to add an eye fixation point when starting the exercise, adding this fixation point makes it easier to maintain the eye fixation in the middle.
Level 3	*Visual inhibition*: In level 3 of the Modified Stroop Task, a background color is added. Make sure you inhibit the background color and focus on the main task.

5.2.2 Modified Flankers Task

Main task: A black arrow will appear. Which direction is the arrow pointing at? When the arrow is pointing to the left, press the left button. When the arrow is pointing upwards, press the up button. When the arrow is pointing to the right, press the right button. When the arrow is pointing downwards, press the down button.

Levels	**Added cognitive ability**
Level 1	*Main task*
Level 2	*Motor inhibition:* In level 2 of the modified Flankers Task, an arrow will appear in the same way as in the main task. However, the arrow may be black, green, or red. When the arrow is black, the correct response is the same as in the main task. When the arrow is green, press the button 90 degrees clockwise compared to the direction that the arrow is pointing in. When the arrow is red, press the button 90 degrees counter-clockwise compared to the direction that the arrow is pointing in. The initial reaction in this task will probably be pressing the button of the arrow's direction, however, it is needed to inhibit that initial response and consider the colors before actually pressing a button.
Level 3	*Peripheral vision*: In level 3 of the Modified Flankers Task, the colored arrows, as described in level 2, appear at different locations. Again, make sure the eye fixation is in the middle of the screen. It is possible to add an eye fixation point when starting the exercise, this way, it is easier to maintain the eye fixation in the middle.
Level 4	*Visual inhibition*: In level 4 of the Modified Flankers Task the colored arrows, as described in level 2, appear. However, these arrows will be surrounded by distracting

	arrows that are pointing in different directions. Make sure you focus on the arrow in the middle and inhibit the surrounding arrows.

5.2.3 Visual Working Memory Task

Main task: In the Visual Working Memory Task. Symbols, such as a circle, triangle, or square, will appear sequentially. Remember every symbol and check whether the symbol that appears matches the previous symbol. When the symbols are congruent (match), press the left button. Press the right button when the symbols are incongruent (do not match).

Levels	Added cognitive ability
Level 1	*Main task*
Level 2	*Peripheral vision:* In level 2 of the Visual Working Memory Task, the symbols appear at different locations. Make sure the eye fixation is in the middle of the screen. It is possible to add an eye fixation point when starting the exercise, this way, it is easier to maintain the eye fixation in the middle.
Level 3	*Added working memory load:* In level 3 of the Visual Working Memory Task, again, symbols will appear sequentially. However, for this level, you need to check whether the symbol that appears (n) matches the symbol before the previous symbol (n-2).

5.2.4 Pattern Recognition Task

Main task: Several numbers will appear. The goal is to make a row of similar numbers. To do so, one number needs to be moved in a specific direction. Press the button that indicates the direction the number needs to go to complete the pattern.

Levels	Added cognitive ability
Level 1	*Main task*
Level 2	*Visual inhibition:* In level 2 of the pattern recognition task more numbers appear. This way, the long row of numbers may draw your attention first instead of the number that needs to be moved in the right direction. Keep focused, gaze, inhibit the long row, and react the same as explained in the main task.

5.3 Start Exercise

Before actually starting an exercise be aware that there are many adjustable settings. The setting possibilities depend on the task of your choice.

5.3.1 Duration

It is possible to choose the duration of the exercise when starting a new exercise. The duration options are 20/30/40/60/80/100 seconds.

5.3.2 Interval

Within an exercise, several stimuli appear. The time between the appearance of those stimuli is called the interval. It is possible to choose the duration of this interval. The duration options are 0/0.5/1/1.5/2 seconds.

5.3.3 Levels

Every cognitive task includes several levels. Level 1 is the most basic level of the cognitive task. Higher levels have an increased difficulty or include added cognitive abilities.

5.3.4 Language

For the Modified Stroop Task, Kinisi has the option to change its exercise language. The language options are English, indicated by the letters EN, or Dutch, indicated by the letters NL.

5.3.5 Colors

Kinisi has the option to add a variety of colors to some of the levels of the cognitive tasks. This way it is possible to perform a motor task based on the colors appearing in the cognitive tasks. For other levels, colors are already included and have a meaning within the cognitive task itself.

5.3.6 Fixation Point

Kinisi has the option to add a central fixation point to the levels in which the stimuli are displayed at various locations. This way, it is easier for the player to fixate their vision in the middle of the screen and perform the exercises using peripheral vision.

5.3.7 Players

As already mentioned in Chapter 3.4 it is possible to connect a player when performing an exercise. This way, it is possible to save the data of the exercise performed.

5.4 Exercise Feedback

The feedback page shows several outcome parameters of the exercise performed. Such as information regarding your reaction time, accuracy, and consistency. On the feedback page, it is also possible to add a comment to your exercise and indicate how well a motor task was performed.

5.4.1 Reaction Time Graph

Every reaction to a stimulus within an exercise is displayed in the reaction time graph. The reaction time is measured in milliseconds (Y-axis), see Figure 5 items 1-5. Be aware that this reaction time also includes the processing speed of the controller and computer.

The overall mean reaction time, mean reaction time for correct answers, and mean reaction time for incorrect answers are also displayed on the right side of the feedback page (Figure 5, items 11-13).

5.4.2 Task Difficulty, Player Performance, and Additional Comments

It is possible to rate the task difficulty and player performance (of the motor task) on a 5-point rating scale (Figure 5, items 5 & 6). A supervisor can also add a comment to the exercise results (Figure 5, item 7). These results will be visible within the exercise database.

5.4.3 Total score, % Correct, % Consistency

Besides variables based on the reaction time, the feedback page also shows a total score, % of correct answers, and % of consistency (Figure 5, items 8-10). The total score is the number of answered stimuli, both correct and incorrect. The % correct answers is the number of correct answers divided by the total number of answers times 100%. The % consistency is the Root Mean Square Error (RMSE) of all data points as a percentage.

5.4.4 Saving Exercises

Leaving the feedback page in any possible way (apart from closing the browser) will automatically save the exercise data. You can manually download the data in CSV format with the download button, Figure 3, item 4.

Chapter 6 Cognitive Background Information

The strength of Kinisi is the ability to perform a combination training, also called dual-task training. Since Kinisi allows the output of the exercises to be generated using an external controller, it is possible to combine the cognitive tasks with motor tasks. The combination training demands the brain to divide attention between several tasks [4]. For the motor task, it is recommended to choose a goal-driven task. For example, when a player finds it difficult to maintain balance, perform a balance exercise as motor task. The tasks within Kinisi mainly focus on the domains of executive functioning and simple reaction time. In the following paragraphs, the basic principles of the cognitive background behind Kinisi tasks are explained. Be aware that there is a large overlap in the use of cognitive abilities. Some cognitive abilities have already been briefly explained in Chapter 5.2 Exercises.

6.1 Reaction Time

All cognitive tasks within Kinisi include aspects of reaction time tasks. However, only a few specific levels of cognitive tasks are designed as simple reaction time tasks. In simple reaction time tasks, the player needs to respond to one stimulus as quickly as possible [5]. When cognitive functioning is impaired, a slower reaction time is often found [5]. In psychological testing, this simple reaction time task may be extended by including multiple output possibilities or using multiple stimuli [5]. The level 1 Modified Flankers Task is the clearest example of a simple reaction time task. For this level, four possible stimuli may appear, which all match their specific response.

6.2 Working Memory

Working memory is seen as the workspace of the brain [6]. Its capacity is limited, however not equal for every individual [6]. The working memory mediates the performance of cognitive tasks by functioning as a brain area where information is temporarily stored and manipulated [6]. Over the past decades, there has been an increasing interest in working-memory training. All levels of the ‘Working Memory Task’ aim to focus on specifically training the working memory. However, remembering the instructions of a task and acting as told in these instructions also demands the use of the working memory.

6.3 Motor and Cognitive Inhibition

Motor and cognitive inhibition is the inhibition of planned or prepotent responses and maintaining attention [7]. The inhibition of a response means you need to suppress the response. This is useful in the limitation of impulsive responses and the regulation of emotions [7]. Moreover, it is also useful in goal-directed behavior, in for example sports [7]. Various tasks within Kinisi aim to focus on motor and cognitive inhibition. Different ways of inhibitions are added in Kinisi. In level 3 of the Modified Stroop Task and level 4 of the Modified Flankers Task, we added distracting surroundings that need to be visually inhibited. In levels 2, 3, and 4 of the Modified Flankers Task, an extra instruction to the color of the arrow is added. Thereby, it is needed to inhibit a first initial reaction, plan a second reaction based on the colors and then press the correct button. Levels 1 and 2 of the Modified Stroop Task demand your brain to see whether the color and the word are congruent or incongruent. Level 3 of the Modified Stroop Task also demands your brain to inhibit the background color.

6.4 Pattern Recognition

Pattern recognition is one of the perceptual-cognitive skills on which research focused the last decades [8]. Mainly due to its central role in learning processes and problem-solving [9]. When an individual comes across a new situation in daily life, they search for patterns to apply earlier learned information in this new situation [9]. In Kinisi one simple task aiming to improve pattern recognition is included, being the ‘Pattern Recognition Task’.

Chapter 7 Error Handling

As Aristotle Technologies we aim to provide you with problem-free software. However, if for any reason you run into technical issues or come across any type of bug within the software, we kindly ask you to send an email to *support@aristotletechnologies.com*. Thank you in advance!

Chapter 8 Literature

1. Bahar-Fuchs, A., Martyr, A., Goh, A.M., Sabates, J., Clare, L. (2019). Cognitive training for people with mild to moderate dementia. *Cochrane Database of Systematic Reviews.* 25;3(3).

2. Mateos-Aparicio, P., Rodríguez-Moreno, A. (2019). The Impact of Studying Brain Plasticity. *Frontiers in Cellular Neuroscience.* 13:66.

3. Wollesen, B. Wildbredt, A., van Schooten, K.S., Lim, M.L., Delbaer, K. (2020). The effects of cognitive-motor training interventions on executive functions in older people: a systematic review and meta-analysis. *European review of Aging and Physical Activity.* 17(9).

4. Wollesen, B., Janssen, T.I., Müller, H., Voelcker-Rehage, C. (2022). Effects of cognitive-motor dual task training on cognitive and physical performance in healthy children and adolescents: A scoping review. *Acta Psychologica.* 224.

5. Stebbins, G.T. (2007). Chapter Neuropsychological Testing in Textbook of Clinical Neurology (Third Edition). Elsevier Inc.

6. Morrison, A.B., Chein, J.M. (2011). Does working memory training work? The promise and challenges of enhancing cognition by training working memory. *Psychonomic Bulletin & Review.* 18(1): 46-60.

7. Leshem, R., De Fano, A., Ben-Soussan, T.D. (2020). The Implications of Motor and Cognitive Inhibition for Hot and Cool Executive Functions: The Case of Quadrato Motor Training. *Frontiers in Psychology.* 11:940.

8. Vestberg, T., Gustafson, R., Maurex, L., Ingvar,M., Petrovic, P. (2012). Executive Functions Predict the Success of Top-Soccer Players. *PLoS ONE.* 7(4): e32731.

9. Guare, R. (2014). Context in the Development of Executive Functions in Children. *Applied Neuropsychology: Child.* 3:3, 266-232.