SOFTWARE REQUIREMENTS SPECIFICATIONS for BRAINWORKSHOP

Version Brain Workshop 4.8.4

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Contents

REVISION HISTORY

PROJECT NAME	RELEASE DATE	VERSION
BRAINWORKSHOP	13-08-2008	Brain Workshop 2.4
BRAINWORKSHOP	13-08-2008	Brain Workshop 2.6
BRAINWORKSHOP	15-08-2008	Brain Workshop 2.7
BRAINWORKSHOP	18-08-2008	Brain Workshop 3.1
BRAINWORKSHOP	14-10-2008	Brain Workshop 4.0
BRAINWORKSHOP	26-10-2008	Brain Workshop 4.1
BRAINWORKSHOP	01-11-2008	Brain Workshop 4.2
BRAINWORKSHOP	09-11-2008	Brain Workshop 4.22
BRAINWORKSHOP	15-11-2008	Brain Workshop 4.3
BRAINWORKSHOP	03-09-2009	Brain Workshop 4.4
BRAINWORKSHOP	18-02-2010	Brain Workshop 4.7
BRAINWORKSHOP	10-07-2015	Brain Workshop 4.8

1.INTRODUCTION

1.1 Purpose

The purpose of this document is to present a detailed description of the open-source software Brain Workshop. It will explain the purpose and the features of the software , the interfaces of the software, what the software will do and the constrains under which it must operate . This document is intended for users of the software and also potential developers.

1.2 Document Conventions

This document was created based on the IEEE template for System Requirement Specification Documents.

1.3 Intended Audience and Reading Suggestions

- Education uses for users such as students, who want to use Brain Workshop for analyzing the function of the short term memory and for general experimental use.
- Typical Users in their Desktop, in order to practice and improve their memory.
- Advanced or Professional users, such as scientists and brain researchers, who want to use Brain Workshop as a method to improve the fluid intelligence also known as “smarts” and for general experimental use .
- Healthcare Industries which can use the software in practice for health purposes.
- Programmers who ate interested in working on the project by further developing it or fix existing bugs.

1.4 Product Scope

Brain Workshop implements the dual N-back task which is a memory task which may improve working (short term) memory and fluid intelligence according to a 2008 study published in the PNAS scientific journal. Also Brain Workshop allows users to attempt to improve their own working memory and fluid intelligence.

1.5 References

Brain Workshop's website :

http://brainworkshop.sourceforge.net/

IEEE Template for System Requirement Specification Documents:

https://goo.gl/nsUFwy

Wired Article for introduction to the Dual N-Back exercise :

https://www.wired.com/2008/04/forget-researchers-develop-software-that-makes-you-smarter/

GNU General Public License version 2.0 (GPLv2) :

https://www.gnu.org/licenses/old-licenses/lgpl-2.0.html

2.Overall Description

2.1 Product Perspective

Brain Workshop is free open source Python implementation of the Dual N-Back mental exercise. This exercise is the only mental activity scientifically proven to improve the short term memory and IQ. The game is about remembering a specific sequence of spoken letters and a sequence of positions of a square at the same time, and identifying when a letter or position matches a previous appearance. The software can closely replicate the conditions of the original study. The game modes are Dual 1-Back, Dual 2-Back. It also includes optional extended game modes such as Triple N-Back and Arithmetic N-Back, as well as features such as statistic tracking , graphs and configurability.

Brain Workshop is a free open source project and it has an active developer team to support it and provide feedback to users. It was developed to run on Windows, MacOS X and Linux.

2.2 Product Functions

When the user opens the Brain Workshop they can perform the following functions in the software :

- They can Press C – to choose the Mode of the game.

  Options in the Choose your Game Mode menu:

  i. Use position. With available options Yes / No.
  ii. Use color. With available options Yes / No.
  iii. Use image. With available options Yes / No.
  iv. Use audio. With available options Yes / No.
  v. Use audio2. With available options Yes / No.
  vi. Use arithmetic. With available options Yes / No.
  vii. Combination N-Back mode. With available options Yes / No.
  viii. Use variable N-Back levels. With available options Yes / No.
  ix. Crab-back mode (reverse order of sets of N stimuli). With available options Yes / No.
  x. Simultaneous visual stimuli. With available options 1 / 2 / 3 / 4.
  xi. Simultaneous stimuli differentiated by Self-paced mode. With available options: color / image.
  xii. Self-paced mode. With available options Yes / No.
  xiii. Interference (tricky stimulus generation). With available options 0.0% / 12.5% / 25.0% / 37.5% / 50.0% / 62.5% / 72.5% / 87.5% / 100.0%.
  xiv. Esc : cancel.
  xv. Space : modify option.
  xvi. Enter : apply option.

- They can Press S – to Choose Sounds.

  Options in the Choose sound sets to Sound N-Back tasks :

  i. Use sound set ‘corsica-letters’ for channel 1. With available options Yes / No.
  ii. Use sound set ‘letters’ for channel 1. With available options Yes / No.
  iii. Use sound set ‘morse’ for channel 1. Wth available option Yes / No.
  iv. Use sound set ‘nato’ for channel 1. With available options Yes / No.
  v. Use sound set ‘numbers’ for channel 1. With available options Yes / No.
  vi. Use sound set ‘piano’ for channel 1. With available options Yes / No.
  vii. Use sound set ‘corsica-letters’ for channel 2. With available options Yes / No.
  viii. Use sound set ‘letters’ for channel 2. With available options Yes / No.

ix. Use sound set ‘morse for channel 2. With available options Yes / No.
x. Use sound set ‘nato for channel 2. With available options Yes / No.
xi. Use sound set ‘numbers’ for channel 2. With available options Yes / No.
xii. Use sound set ‘piano’ for channel 2. With available options Yes / No.
xiii. Channel 1 is. With available options center / left / right.
xiv. Channel 2 is. With available options center / left / right.
xv. Esc : cancel
xvi. Space : modify option.
xvii. Enter : apply option.

- They can press I – to Choose Images.

  Options in the Choose images to use for the image N-Back tasks menu.

  i. Cartoon - faces. With available options Yes / No.
  ii. National – park - service. With available options Yes / No.
  iii. Cartoon - faces. With available options Yes / No.
  iv. Pentominoes. With available options Yes / No.
  v. Polygons - basic. With available options Yes / No.
  vi. Cartoon - faces. With available options Yes / No.
  vii. Tetrominoes – fixed. With available options Yes / No.
  viii. Esc : cancel
  ix. Space : modify option.
  x. Enter : apply option.

- They can press U – to Choose User.

Brain Workshop allows for multiple user profiles on the same computer. Each profile keeps separate statistics records (stats.txt files) and configuration (config.ini files). Restarting Brain Workshop is required if the profiles differ in their WINDOW_FULLSCREEN or BLACK_BACKGROUND config.ini options.

Options in the Please select you user profile menu.

i. New User. With available options to select a username.
ii. Default. Which selects the default user as the username.
iii. Esc : cancel
iv. Space : modify option.
v. Enter : apply option.

- They can press G – Daily Progress Graph.

  Options in the Dual N-Back menu.

  i. G : To return to Main Screen.
  ii. N : Next Game Type.

In the menu there is graph for the Game which shows the results between Maximum Average Score and Date.

(more information about Graphs and Statics on section 4. on this document)

- They can press H – for Help or Tutorial.
  When the user Presses H the software directs him to the Brain Workshop page at the Tutorial section.

- They can press D – to Donate.
  When the user Presses D the software directs him to the Brain Workshop page at the Donate section.

- They can press F – to go to Forum or Mailing List.
  When the user Presses F the software directs him to the group page in Google at the Mail section.

- They can press O - to Edit Configuration file.
  When the user Presses O the software opens him the text config.ini.
  Many features of Brain Workshop are configurable by editing the config.ini file for that user. This file can also be found in Brain Workshop's data folder, located here on the users computer :
  - Windows: C:\Users\[username]\AppData\Roaming\Brain Workshop\data
  - Mac: On Mac the config file is in "Library/Application Support/Brain Workshop/data" . The Library folder is in your home folder and is normally hidden.
  - Linux: ~/.brainworkshop

  (more information about the configurations options on section 4. of this document)

- They can press SPACE to ENTER THE WORKSHOP.
  When the user Presses SPACE the software goes to the Dual N-Back Game Interface.
  With options :

i. H : Help / Tutorial.
ii. C : Choose Game Type.
iii. S : Select Sounds.
iv. I : Select Images.
v. M : Manual Mode.
vi. D : Donate.
vii. G : Daily Progress Graph.
viii. W : Brain Workshop Site
ix. ESC : Exit.
x. Press SPACE to begin session.

- Session Parameters and Thresholds
  Brain Workshop always uses the same starting n-back level, number of trials and time per trial, making it easier to compare scores. Every day you'll begin at a certain n-back level which varies depending on the game mode. Currently these are specified as follows:

  All modes are 20 trials per session and 3 seconds per trial.
  Dual & Triple N-Back begin with 2-back
  All other modes (Combination N-Back, Arithmetic N-Back) begin with 1-back
  Brain Workshop uses an adaptive level-changing model which will increase or decrease your n-back level depending on your performance.
  A score of 80% or greater: n-back level is increased.
  A score of 50% to 79%: n-back level is maintained.
  Three scores of below 50%: n-back level is decreased.

2.3 User Classes and Characteristics

- **Education**. For instance users such as students, who want to use Brain Workshop for analyzing the function of the short term memory and for general experimental use.

- **Health Industries.**

- **Science / Research.**

- **Advanced / End Users** or Professional Users, such as scientists and brain researchers, who want to use Brain Workshop as a method to improve the fluid intelligence also known as “smarts” and for general experimental use .

- **Developers** or Programmers who ate interested in working on the project by further developing it or fix existing bugs.

2.4 Operating Environment

- Windows 2000
- Windows XP
- Windows Vista
- Windows 7
- Windows 8
- Windows 10
- Mac OS X
- Linux

2.5 Design and Implementations Constraints

Brain Workshop is developed in Python, it uses OpenGL for its visualization engine and has been built on of the Python 2.6.1 IDLE. Any programmer can make modifications in the source code by downloading the brainworkshop-4.8.1.zip and using a Python Editor IDLE.

2.6 User Documentation

There is a tutorial on how to play the Dual N-Back game at the Brain Workshop official page :

https://www.brainworkshop.sourceforge.net/tutorial.html

Also there are many documentations on the Dual N-Back game for users who would like to learn more about this exercise

There is a Wired Article for an introduction to the Dual N-Back exercise and benefits :

https://www.wired.com/2008/04/forget-researchers-develop-software-that-makes-you-smarter/

Also there is the original research paper that was introduced to the PNA :

https://www.pnas.org/content/early/2008/04/25/0801268105

Furthermore there are links for anyone who would like to join the Dual N-Back Community :

Forum: https://groups.google.com/forum/#!forum/brain-training

FAQ page: https://www.gwern.net/DNB-FAQ

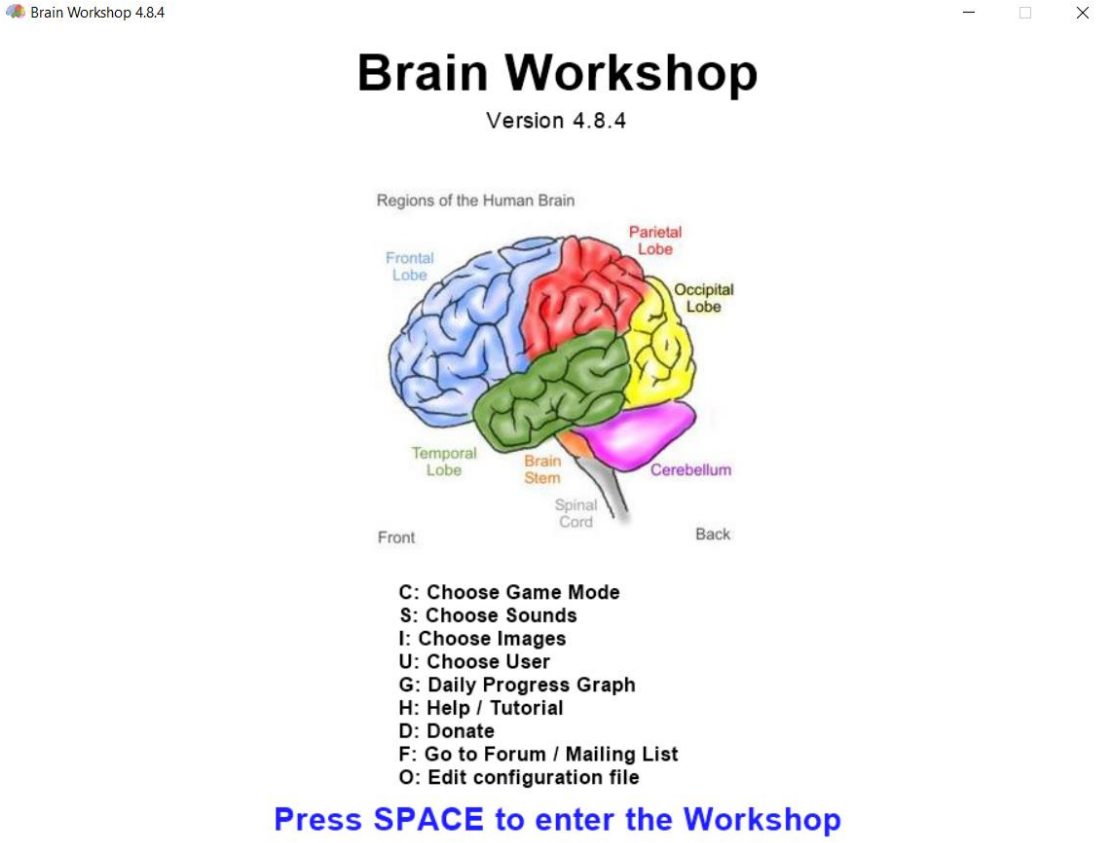
2.7 Assumptions and Dependencies

Brain Workshop doesn't require extra steps to be done to download the software for the Windows Operating System. Although the installation of Brain Workshop for Mac OS X and Linux Operating Systems requires some additional steps.
For users with Mac OS X there is a link in the Brain Workshop page at Download section ,from which they can download the software, if they have OS X 10.3 version or higher. In any other case, because the Brain Workshop was developed in Python the users would have to download and install the Python 2.5.2 for the Mac OS X. It is recommended to also install AVBin for the sound support.
And, for the users with Linux operating system the dependencies are two. Firstly, they most have the OpenGL working as Brain Workshop uses OpenGL for the graphs and a hardware acceleration is also recommended.
And secondly, they must open the terminal and type python to ensure that they have the Python 2.5 or higher.
Most Linux distributions already have the Python preinstalled. Also its recommended for the users to download AVBin for the music support.
Although if the user has an Ubuntu should be aware that previous users have reported some problems with the sound.

3.External Interface Requirements

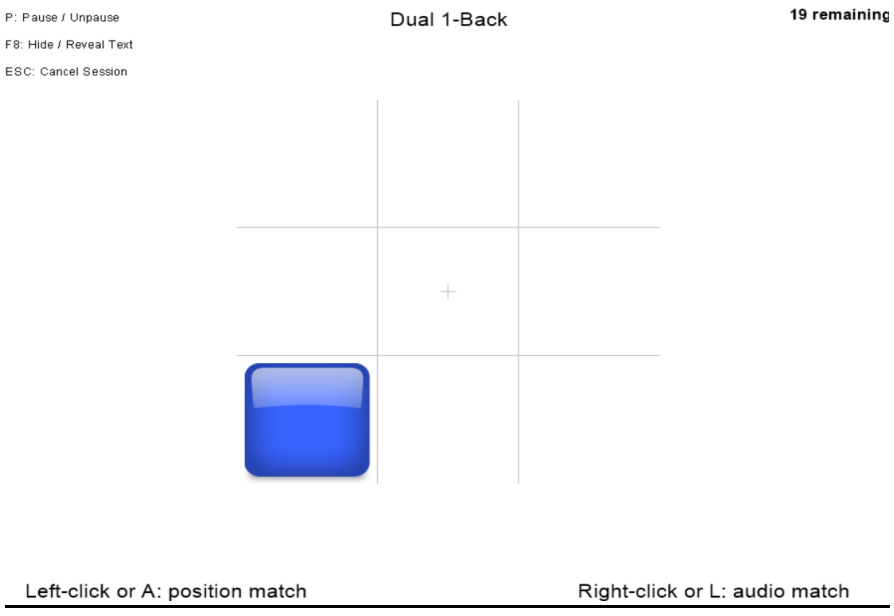
3.1 User Interfaces.

1. Brain Workshop's Main Screen

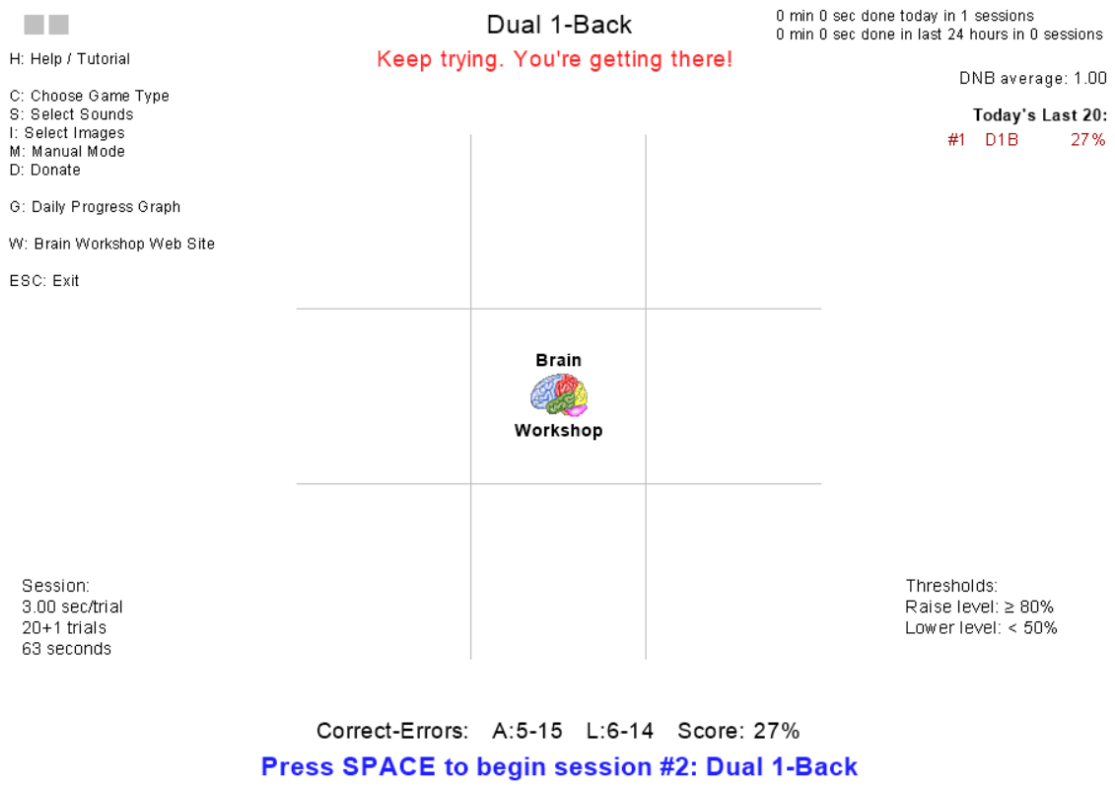


2.Dual N-Back screen

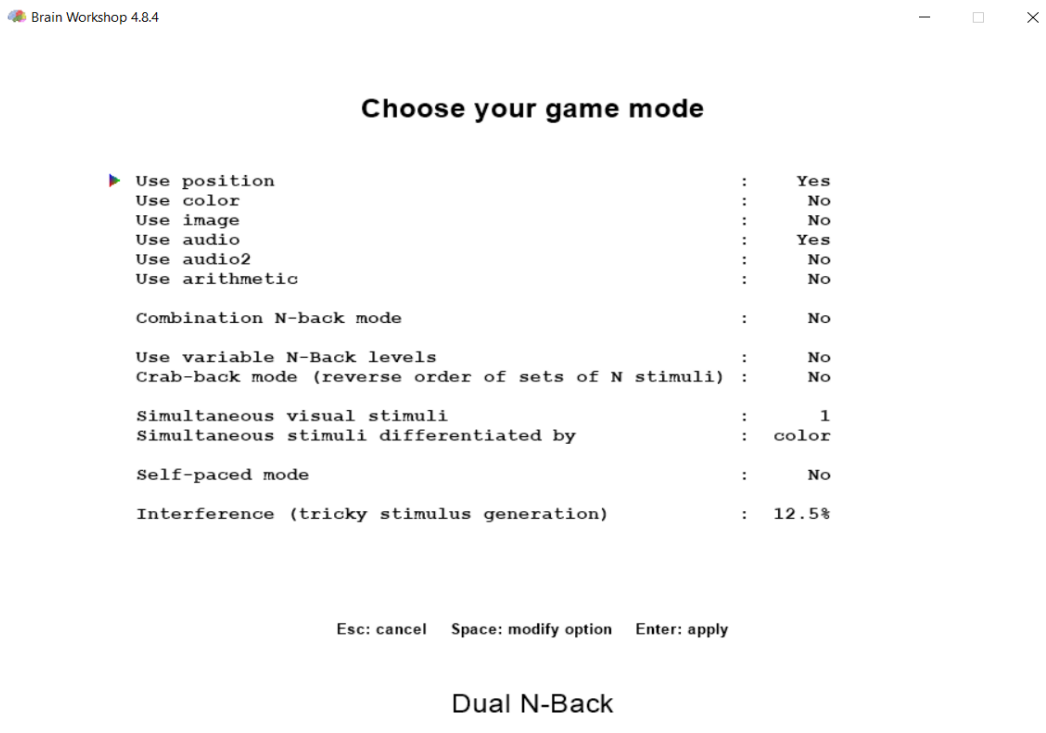
3.Begin Session screen



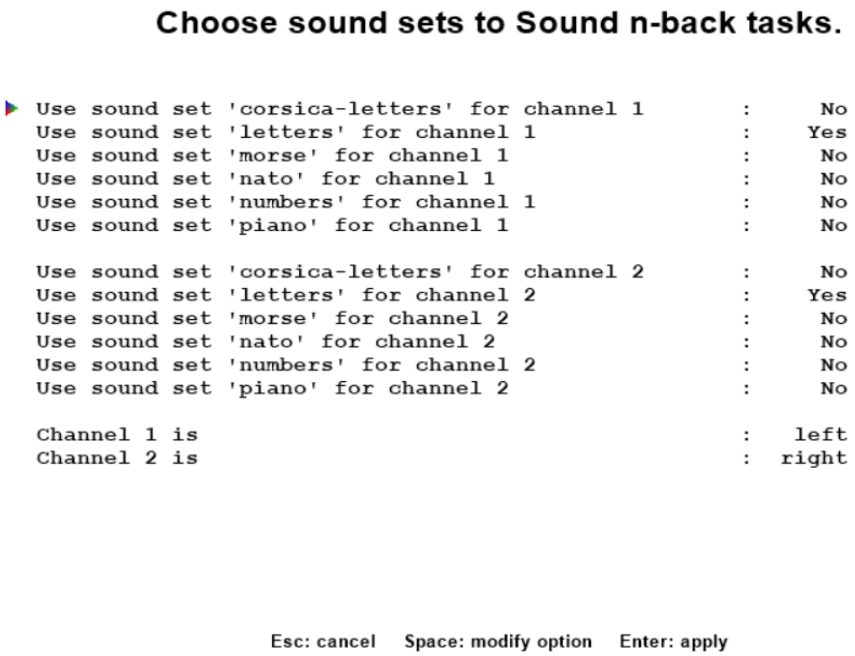
4.End Session screen



5.Choose your game mode screen

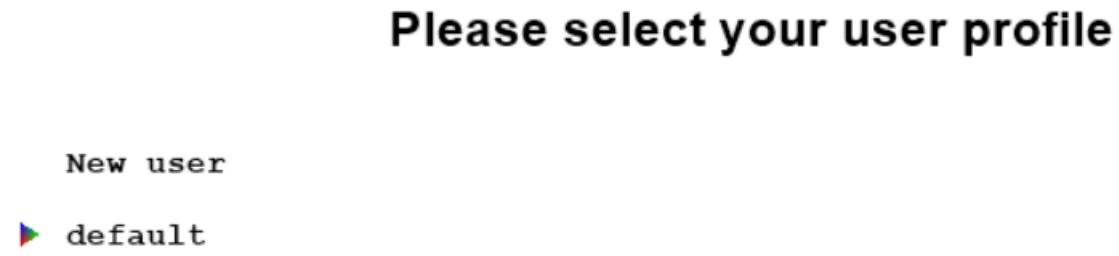


6.Choose sound sets screen

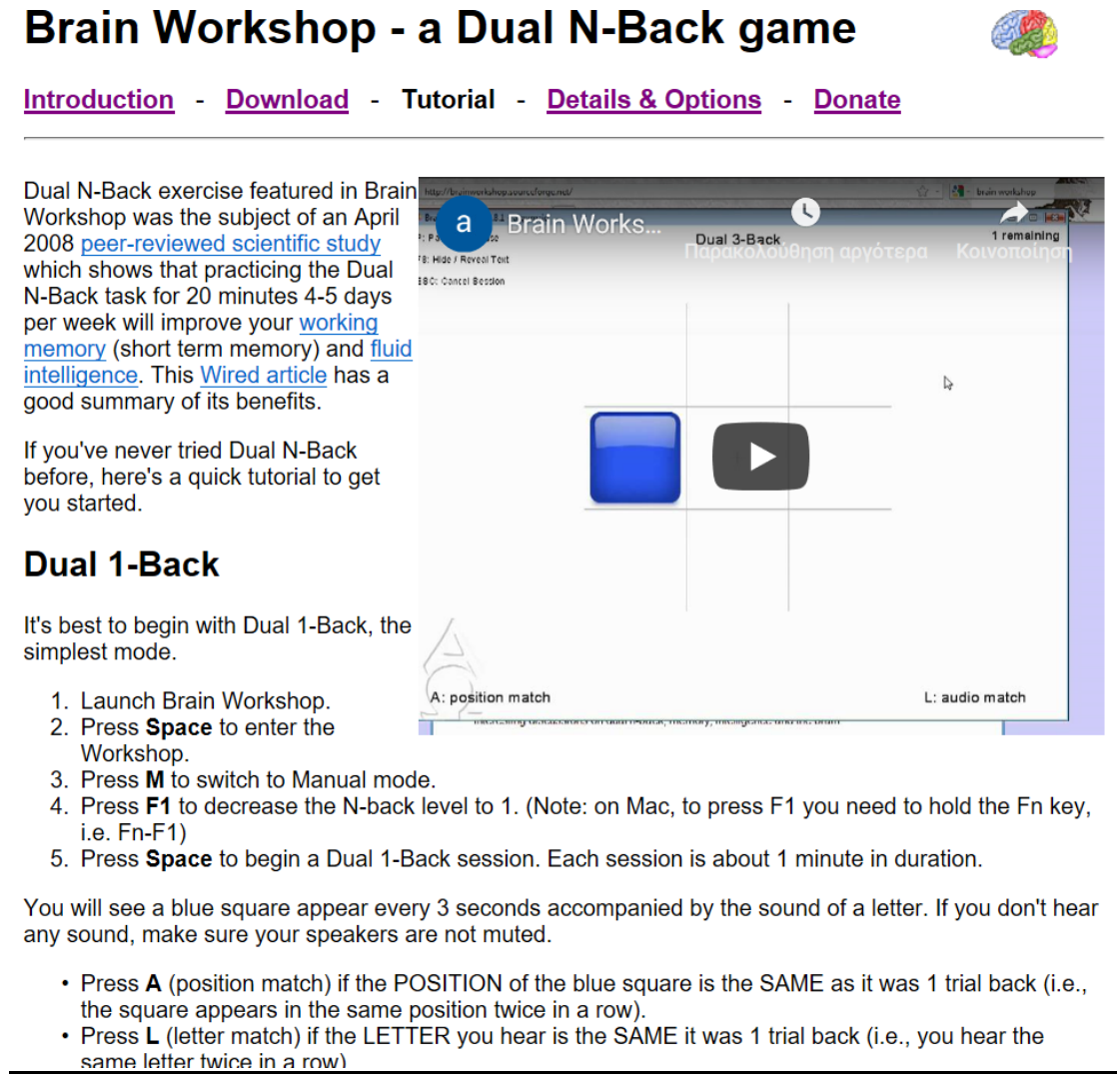


7.Choose Images to Use screen

8.Select user profile



9.Help / Tutorial screen



Where there is explanations on how to play the dual 1-back game.

There is also a tutorial on how to play the dual 2-back game

Dual 2-Back

Brain Workshop starts in Dual 2-Back mode by default. Dual 2-Back is significantly more difficult than Dual 1-Back. Don't be discouraged - **learning and practicing this exercise at the limit of your ability is what increases your fluid intelligence!**

1. Ensure that the game mode is **Dual 2-Back**. (if not, use **F1** and **F2** to adjust the N-Back level. On Mac, to press F1 you need to hold the Fn key, i.e. Fn-F1. Note: these keys will only function in Manual mode.)
2. Press **Space** to begin a Dual 2-Back session.

This time, you will need to remember the square's position and the voiced letter from **2 trials back** instead of 1 trial back.

- Press **A** (position match) if the POSITION of the blue square is the SAME as it was 2 trials back (i.e., the square appears in the same position as it did two trials ago).
- Press **L** (letter match) if the LETTER you hear is the SAME it was 2 trials back (i.e., you hear the same letter as you did two trials ago).

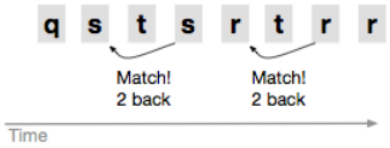
If you find this too difficult at first, try focusing on only one of the cues (either the square's position or the letter).

Here's an example. Ignore the square's position for now and focus on the letters you hear. Suppose the first letter is **"A"** and the second is **"B"**. Now it's the third trial and the letter is **"A"** again.

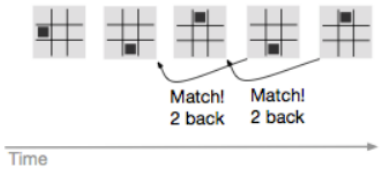
Since the current letter, A, is the same as the letter from two trials ago (i.e., the first trial), you've found a match and press the **L** key. Now suppose that on the next trial the letter is **"B"**. You press **L** again because this word is also the same as it was two trials ago.

Here's another example.

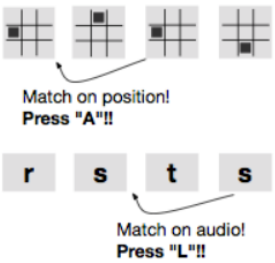
With **2 back**, look for matches 2 steps into the past:



You can also match on **position** of the box:



Hit the keys **"A"** and **"L"** to signal when you found a match:



10.Donate screen

Brain Workshop - a Dual N-Back game

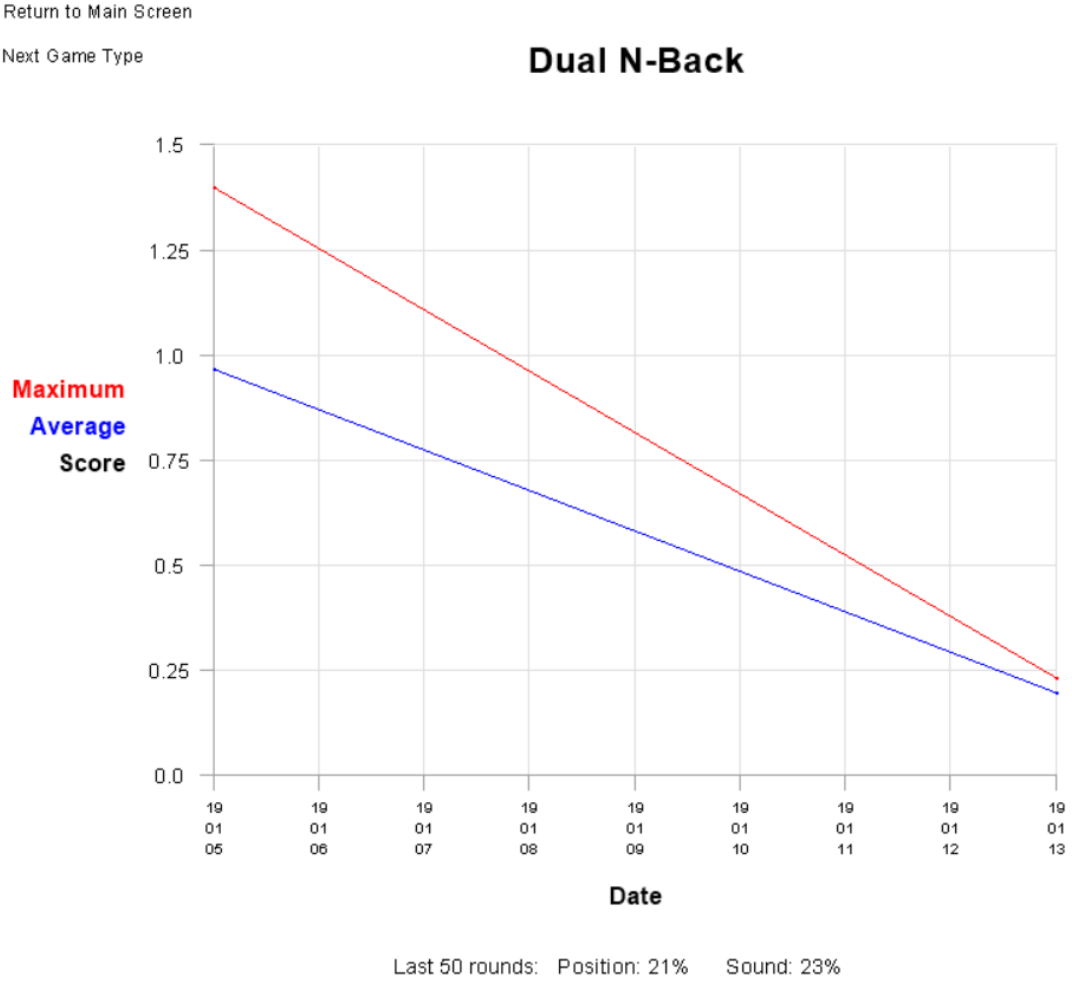
Introduction - Download - Tutorial - Details & Options - **Donate**

Donations are currently disabled. Thank you for using Brain Workshop!

11.Daily Graph

G: Return to Main Screen

N: Next Game Type



Last 50 rounds: Position: 21% Sound: 23%

12.Enter username screen

Brain Workshop 4.8.4

Enter new user name: default

3.2 Software Interfaces

Brain Workshop doesn't require any additional installations for Windows but it requires a Python ,version 2.5 or higher, installation for Mac OS X and Linux. Further information can be found on section 2.7 of this document.

3.3 Communications Interfaces

Brain Workshop requires an internet connection for the Tutorial , Donate and Forum / Mailing list sections but it doesn't require an internet connection to begin Dual N-Back sessions.

4.System Features

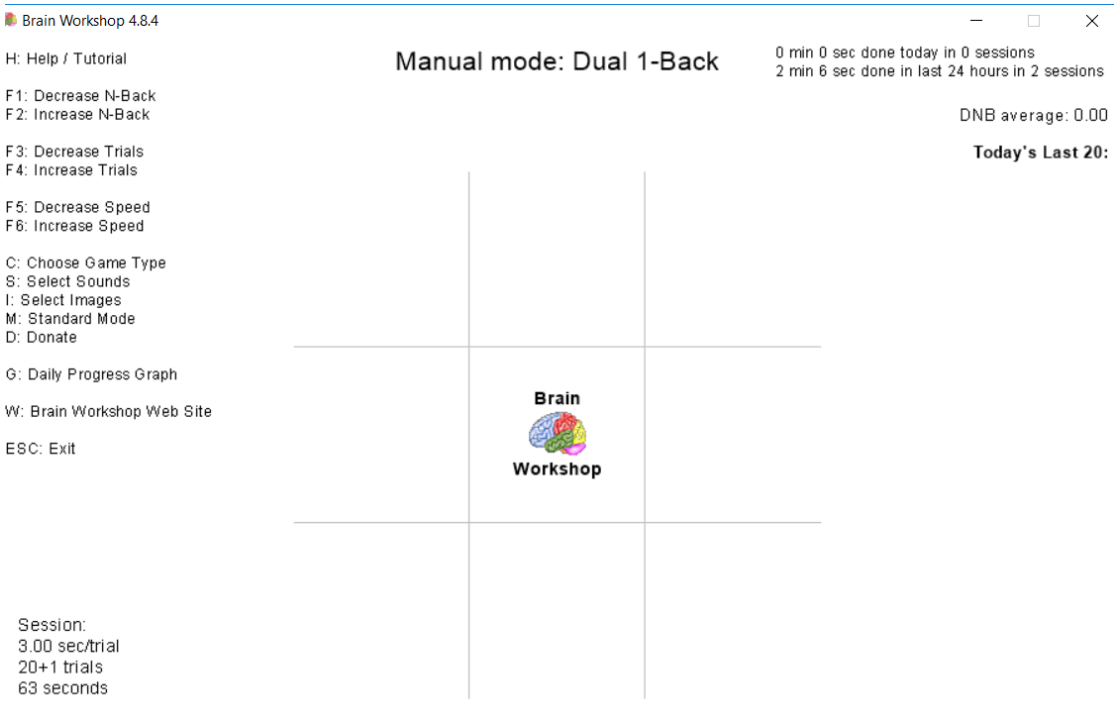
This section demonstrates Brain Workshop's most prominent features and explains how they can be used and the results they will give back to the user.

4.1 Game Modes

- **Dual 1-Back**
  Dual 1-Back is the simplest mode and recommended for beginners. It comes from the fact that the user has to remember two different stimuli : the square's position and the letter played through the speakers. The 1-Back part indicates how many trials back is asked to the user to remember and decide whether that trial's position or letter match the current position or letter.
  To begin the session the user must launch Brain Workshop and press Space to enter the Workshop. Secondly they must press M to switch to Manual mode, press F1 to decrease the N-back level to 1, on Mac Operating System in order to press F1 they need to hold the Fn key at the same time. After that they must press Space to begin a Dual 1-Back session. Each session lasts about 1 minute.
  The user will see a blue square appear every 3 seconds accompanied by the sound of a letter, they must make sure that their speakers aren't on mute in order to hear the sound properly.
  They can press A (for position match) if the position of the blue square is the same as it was 1 trial back or press L (for letter match) if the letter you hear is the same sequence as it was

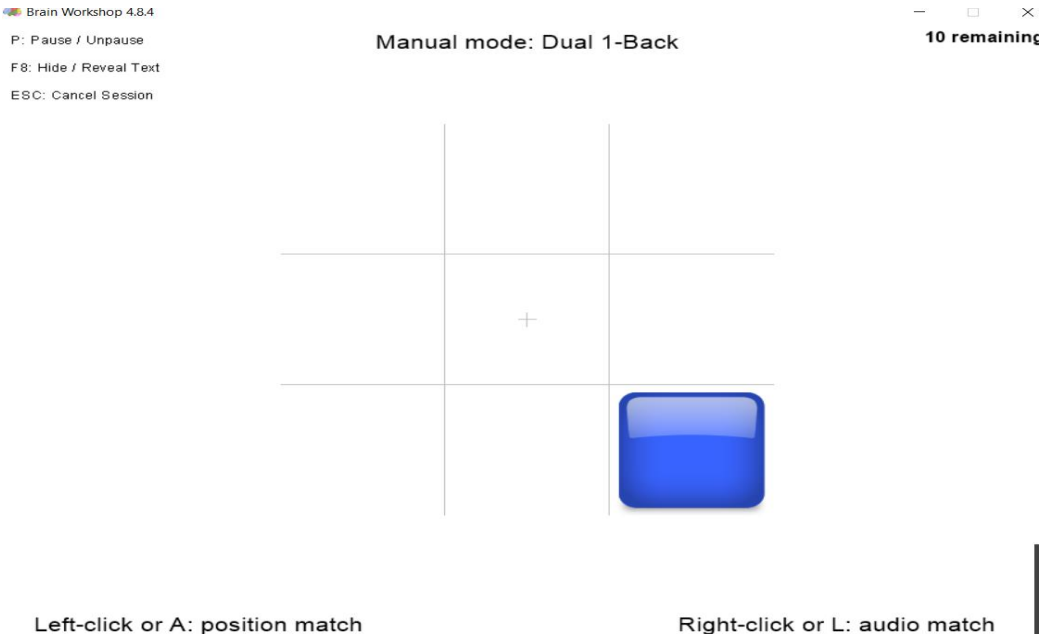
1 trial back. If the position of the blue square or the letter they hear doesn't match then they must press neither of the latter buttons.
When the user press the right button in a trial the button in the interface will turn green from blue. If they don't it will turn red.

Enter the Manual Mode

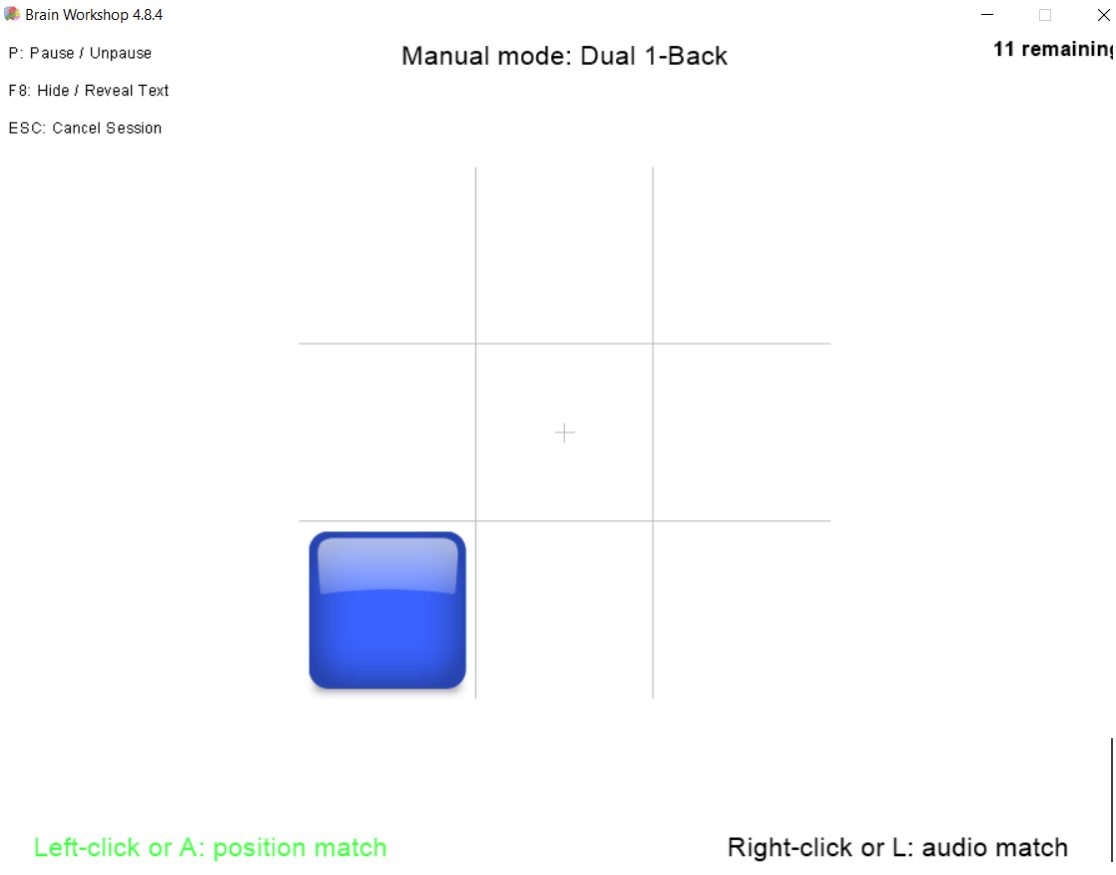


Press SPACE to begin session #3: Dual 1-Back

Neutral Choice



Right choice



Wrong choice

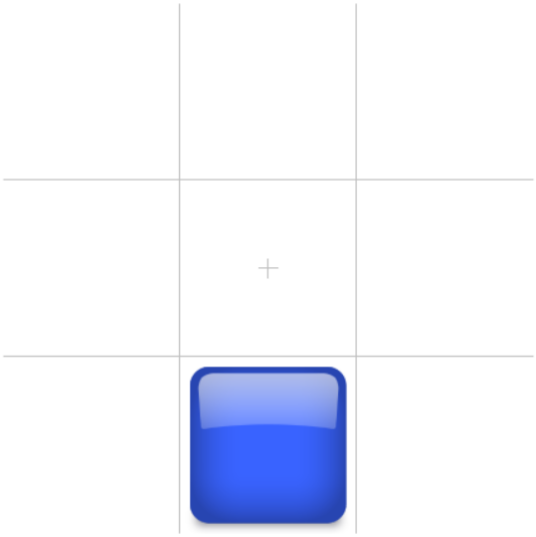
P: Pause / Unpause

F8: Hide / Reveal Text

ESC: Cancel Session

Manual mode: Dual 1-Back

16 remainin



Left-click or A: position match

Right-click or L: audio match

Double right choice

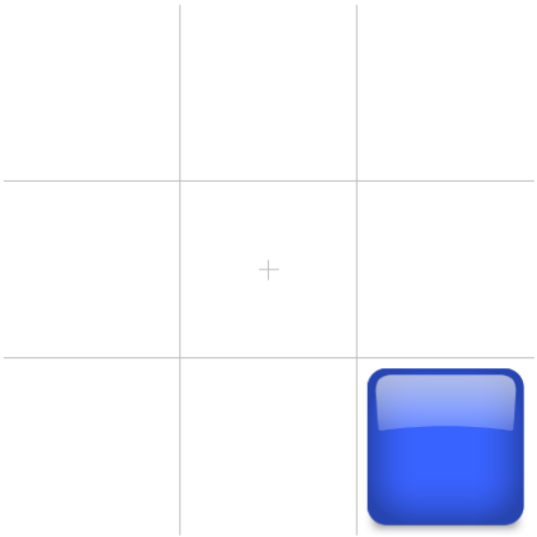
P: Pause / Unpause

F8: Hide / Reveal Text

ESC: Cancel Session

Manual mode: Dual 1-Back

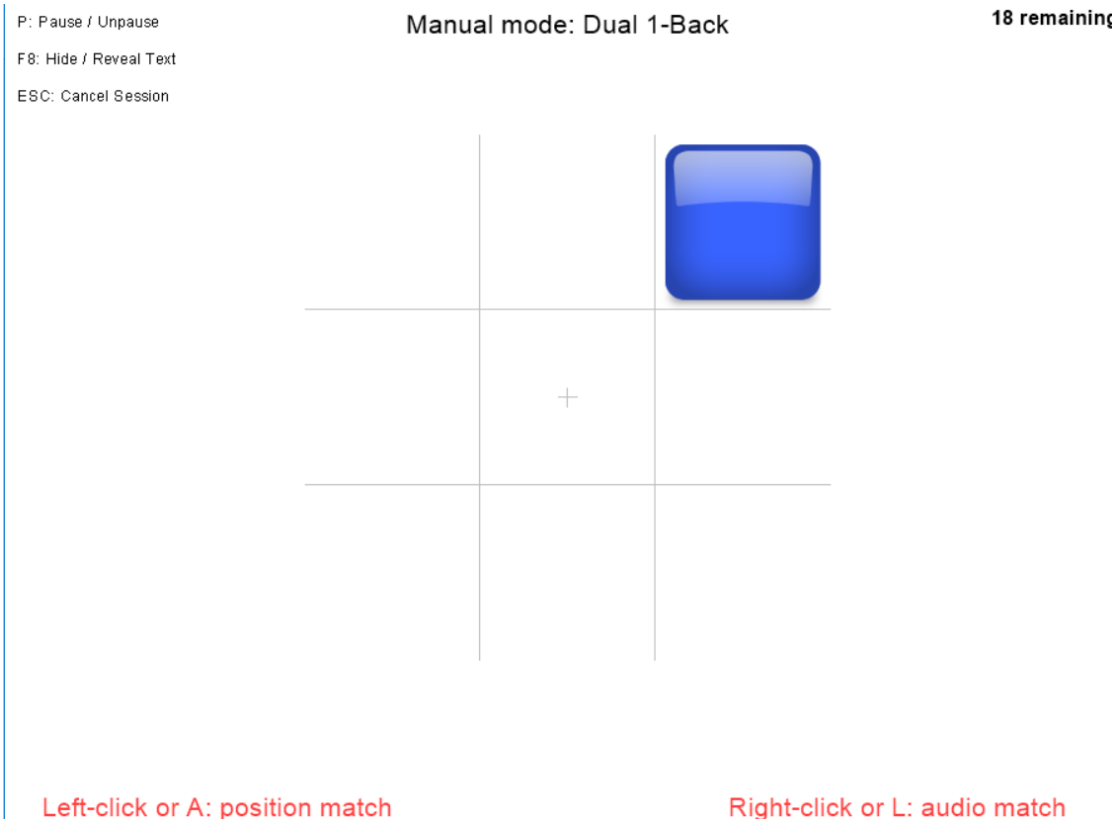
13 remaining



Left-click or A: position match

Right-click or L: audio match

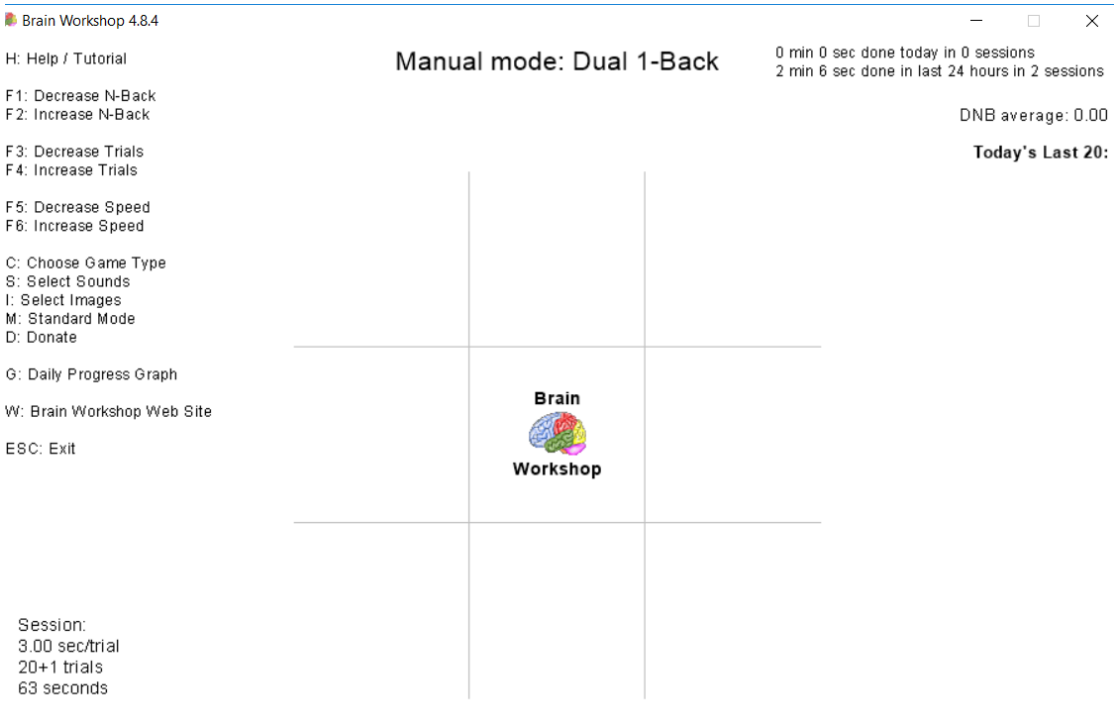
Double wrong choice



- Dual 2-Back
  Brain Workshop starts in Dual 2-Back mode by default. This mode is significantly more difficult than Dual 1-Back. To start a session ensure that the game mode is Dual 2-Back , if not, use F1 and F2 to adjust the N-Back level. On Mac, to press F1 you need to hold the Fn key.
  The user must press Space to begin a Dual 2-Back session. This time, it will be needed to remember the square's position and the voiced letter from 2 trials back instead of 1 trial back.
  They can press A (for position match) if the position of the blue square is the same as it was 2 trials back (the square appears in the same position as it did two trials ago).
  Or press L (for letter match) if the letter they hear is the same it was 2 trials back (you hear the same letter as you did two trials ago).
  It is recommended to focus on one only one of the cues at the beginning if the user finds it difficult.

- Manual Mode

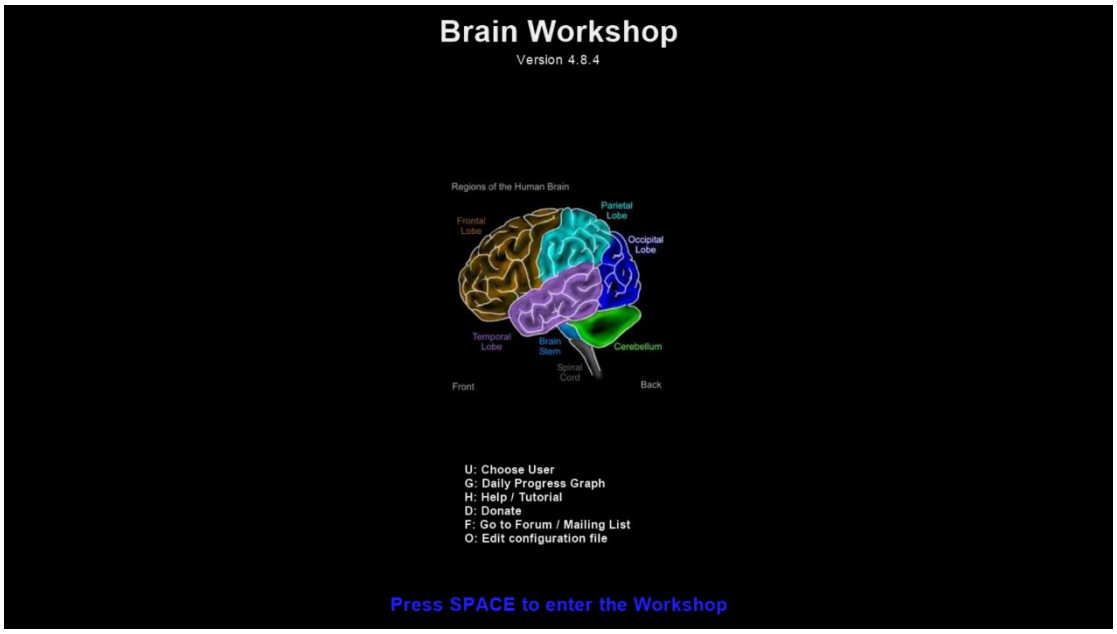
  Manual mode is ideal for experimenting with non-default session parameters. The user can press M to enter Manual mode. Several adjustment keys will become activated, allowing you to modify parameters such as the n-back level, the number of trials or the game speed. In this mode your n- back level is not adjusted automatically based on performance (it remains the same unless you change it manually). However, scores obtained in Manual mode are not plotted on the progress graph.



- Jaeggi Mode

  Brain Workshop has an optional Jaeggi mode which modifies several options to increase the simplicity of the dual n-back task. Jaeggi mode emulates the protocol used in the original research study as closely as possible. Editing the config file setting Jaeggi_MODE = True will cause the following changes:
  The BT-style scoring system is used.
  Non-matches with no inputs are counted as.
  Not pressing any key during a session will give a score of 70 percent. The total score for a session is taken as the lowest of the individual modality scores (visual & auditory).
  The level-changing thresholds are set to the following values which are equal to those used in the original study:
  A score of 90% or greater: n-back level is increased.
  A score of 75% to 90%: n-back level is maintained.

A score of below 75%: n-back level is decreased.
Only Dual N-Back is available in Jaeggi Mode - the other game modes (Triple n-back) are disabled.
When the Jaeggi mode is chosen and the user opens the Brain Workshop App the main screen changes to black by default.

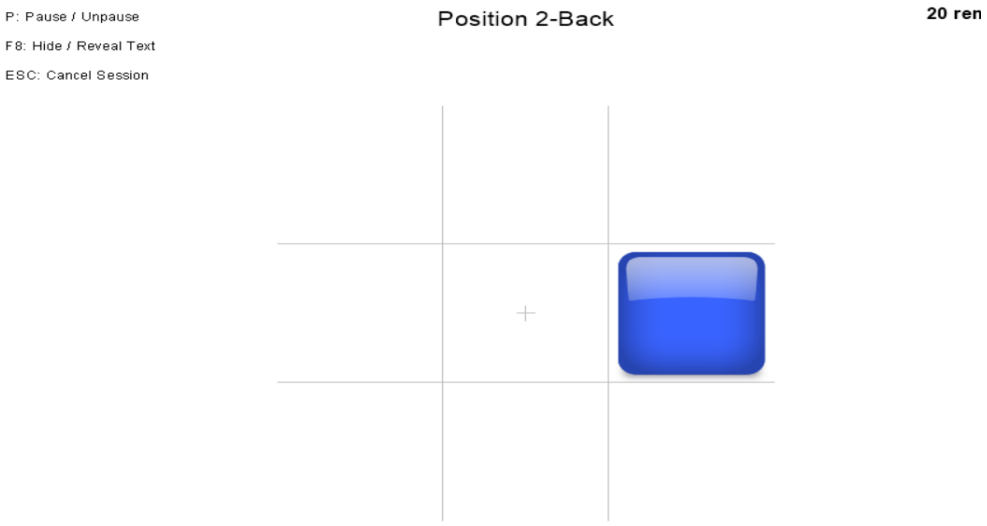


Enter the workshop

Brain Workshop includes two single n-back games for younger children or users who may find Dual N-Back too challenging. The user can press C to select one of the following game modes.

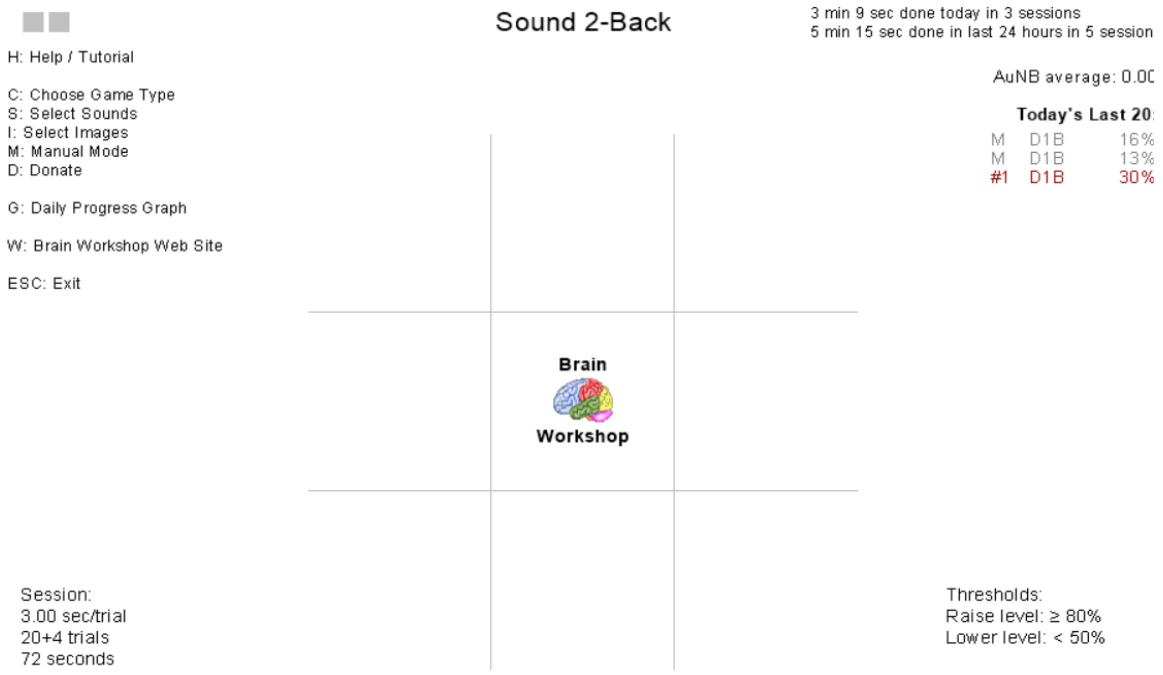
- **Position N-Back**:
  just the visual n-back task**.**
  The cues are only the position of the blue square.
  The user must Press A if position matches n-back position.

Right Position choice

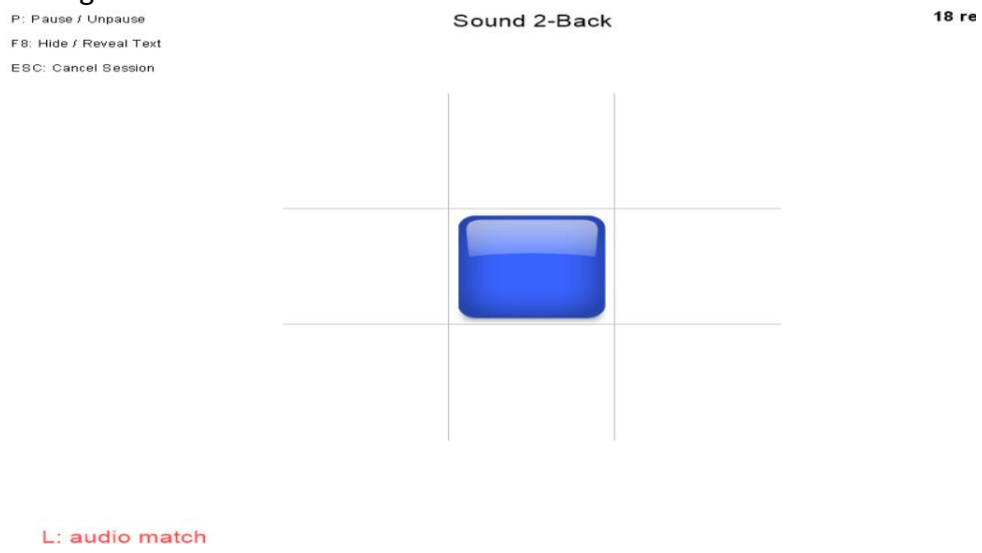


- **Audio N-Back**

  Just the auditory n-back task where the cues are only the sound. The user must press L if the sound matches n-back sound.



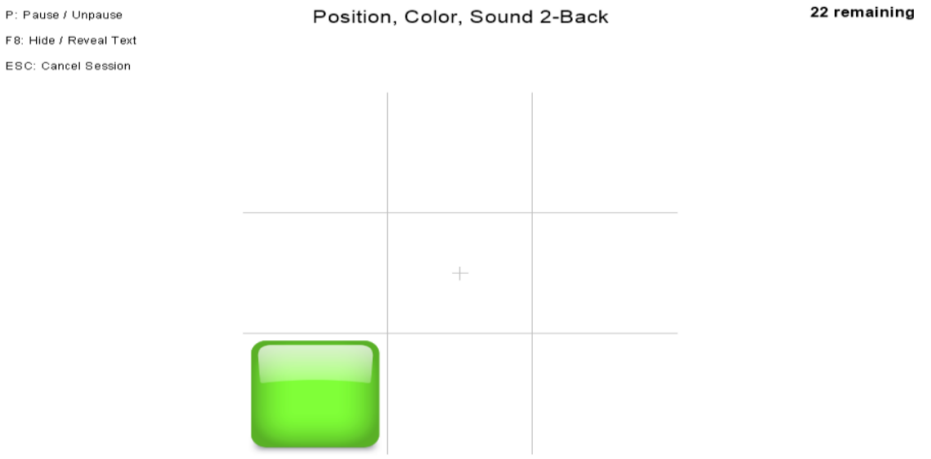
Wrong Sound Choice



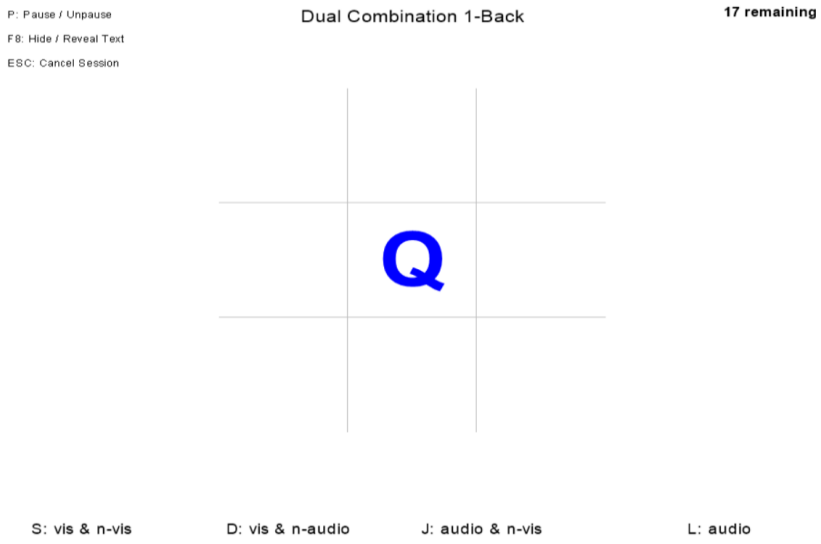
- **Triple N-Back**

  Introduces colored squares as a third cue. Triple N-Back is the next logical step beyond Dual N-Back.
  The overall cues are position, color and sound.
  The user must press A for position matches n-back position, F for color matches n-back color or L for sound matches n-back sound.

  When the session starts the three choices are shown at down left / middle / and right of the screen. The color of the square also changes (colors : black, green, red, white, purple)
  Examples:



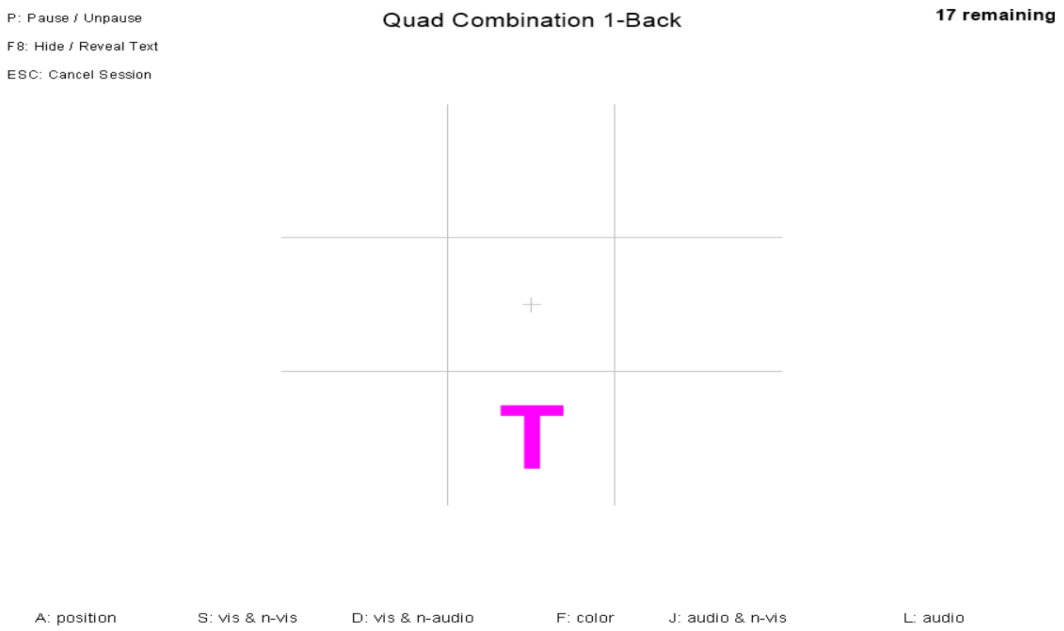
- **Dual Combination N-Back**
  Match visual and auditory cues in multiple ways.
  The type of cues are visual cue, auditory cue.
  The user must press S for visual cue matches n-back visual cue, D for visual cue matches n-back sound, J for sound matches n-back visual cue or L for sound matches n-back sound.
  Images may vary in each session.



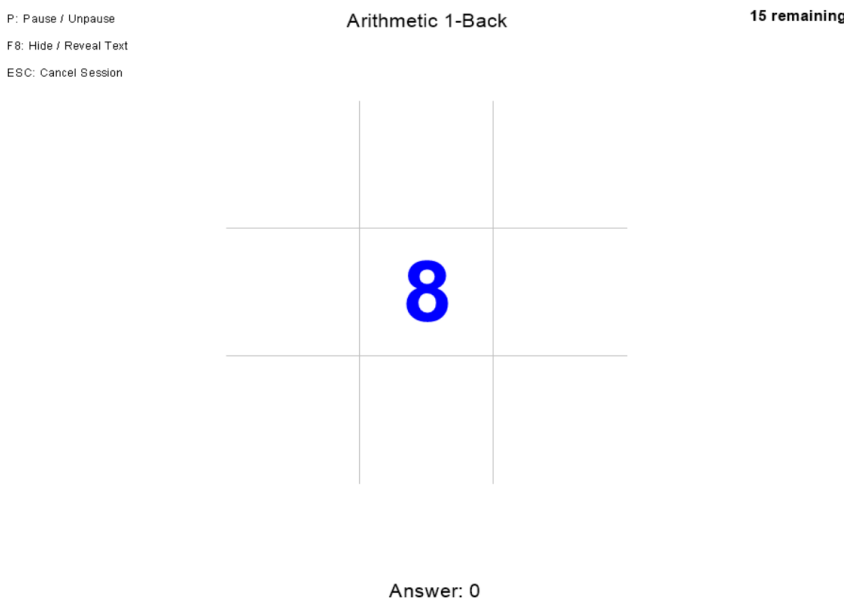
- **Triple Combination N-Back**
  Adds a position cue for more complexity.
  The cues are position, visual cue and auditory cue.

The user can press :
A: if visual's position matches position of n-back visual
S: visual cue matches n-back visual cue
D: visual cue matches n-back sound or J: sound matches n-back visual cue or
L: sound matches n-back sound.

- **Quadruple Combination N-Back**
  Adds a color cue. The ultimate challenge.
  The cues: position, color, visual cue, auditory cue.
  The user can press :
  A: for visual's position matches position of n-back visual
  S: for visual cue matches n-back visual cue
  D: for visual cue matches n-back sound
  F: for color matches n-back color
  J: for sound matches n-back visual cue
  L: for sound matches n-back sound



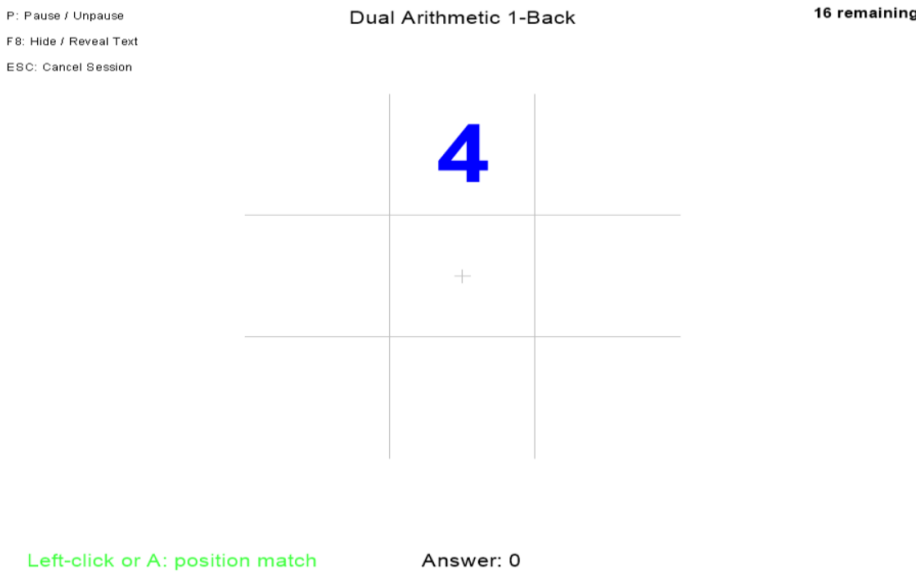
- **Arithmetic N-Back:**
  The user can add, subtract, multiply or divide the n-back number and the current number.
  A number from 0 to 12 appears in the center. An operation (plus, minus, times or divide) is played from the speakers.
  The user apply the current operation to the n-back number and the current number and enter the result. The user can Press the «-» key to indicate a negative answer or
  Press the « . » key to enter a decimal point.
  If they make a typing error they can press Backspace or Delete to clear their answer.
  They can open the configuration file to customize the following parameters:
  Change the maximum number (default: 12)
  Use negative numbers (default: only positive numbers)
  Turn off addition, subtraction, multiplication or division (default: all on)
  The answers in each trial do not depend on each other. Each answer is computed using only the numbers displayed on the board - the n-back number and the current number. The answer should be mentally discarded after keying it in.



First it shows the first number then it speaks the operation and lastly it shows the second number.
When the user enters an answer the Answer frame shows the number the user selected and turns green if the answer was right or red if the answer was incorrect.

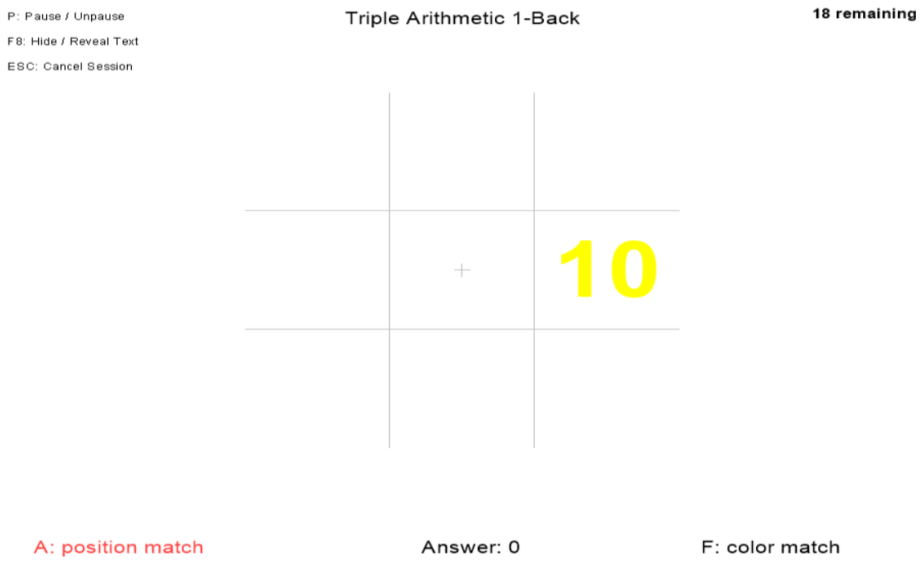
- **Dual Arithmetic N-Back**
  This mode is similar to Arithmetic N-Back except for the addition of a position n-back task. The number will appear randomly in one of the eight positions of the field. The user can Press A if the position of the number matches the n-back position.

  Example :



- **Triple Arithmetic N-Back**
  This mode adds to the challenge of Dual Arithmetic N-Back by incorporating a color n-back task. Press F if the color of the number matches the n-back color.

  Example :

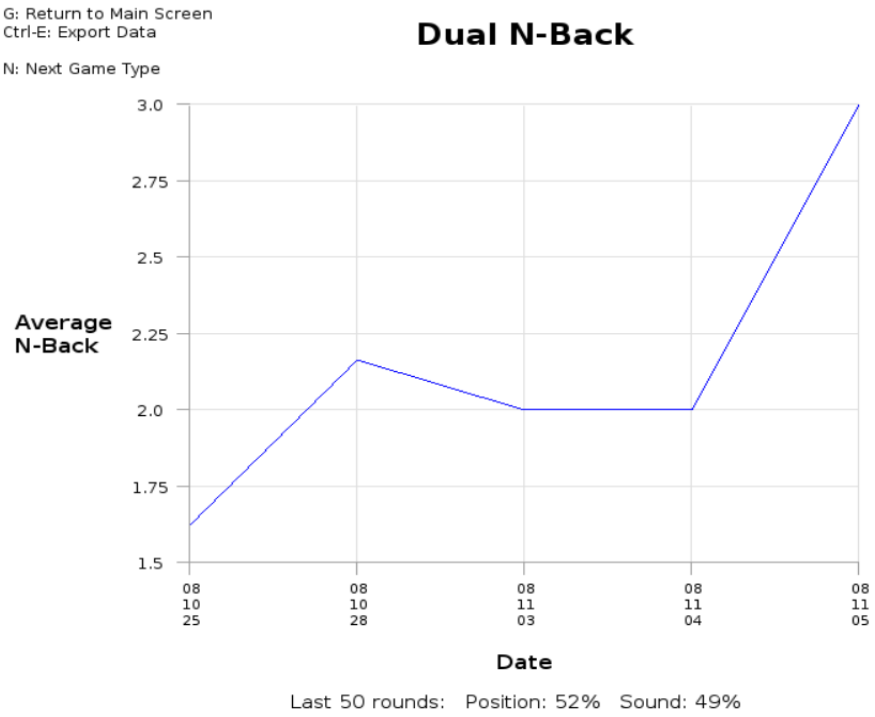


4.2 Graphs & Statistics

The users can see a graph of their daily n-back averages by pressing G. In the graph screen, they can press N to move to the next game mode. The graph shows the average n-back level computed over every session completed that day (as opposed to the indicator in the top right corner of the main screen which only shows the average of the last 20 sessions). Sessions completed in Manual mode are not used in the graph.

By pressing Ctrl-E in the graph screen will export tab-delimited files to the data folder. Each file contains the daily n-back averages by date, in a format suitable for pasting directly into a spreadsheet such as Microsoft Excel.
The average n-back level in the top right corner of the Brain Workshop screen is computed over the last 20 sessions completed today. The contribution of each session to the average is the same as the n-back level of the session. For example, a 2-back session will have a contribution of 2.00. To obtain the average, the total contributions over today's last 20 sessions are divided by the number of sessions.
To clear the session history and the n-back average the users must press Ctrl-C.

Session history is saved in a comma-delimited file called stats.txt in the data folder. In the same folder the users will find a file called Readme-stats.txt which has details on the format of the statistics file. They can clearing the session history by using Ctrl-C has no effect on stats.txt.



4.3 Music Clips

Short music clips will play between sessions depending on your score. The songs included in Brain Workshop are listed (http://brainworkshop.sourceforge.net/music.html). If the user would like to prevent a particular clip from playing, move or delete the corresponding file from the res directory. Music can be turned off altogether by setting the option USE_MUSIC = False in the config file.

4.4 Additional Sounds

Brain Workshop includes several sets of sounds which can be used instead of the default letter sounds. The users can press S to enter the sound selection screen where they can toggle each of the sound sets on or off.
Letters (C, H, K, L, Q, R, S, T)
Numbers (0-13)

NATO Phonetic Alphabet (Alpha, Bravo, Charlie, etc.)
Piano Notes (the C scale, C4-C5)
Morse Code (0-9, A-Z)
If more than one set of sounds is selected, one will be chosen randomly at the start of each session.

4.5 Variable N-Back

For an extra challenge, users can try enabling Variable N-Back by pressing V in the Choose Game Mode screen. Each trial, a random n-back level will be displayed in the center.

4.6 Crab Back

Crab-back modes challenge the users to mentally reverse each block of N stimuli when looking for a match.
It's the same as having a variable value of N for each trial, but instead of having that value of N be random and displayed for each trial like in Variable N-Back modes, it's implicit and follows a regular formula. In 3-Back, the value of N cycles 5, 3, 1, 5, 3, 1, etc. In 4-Back, it cycles 7, 5, 3, 1, etc.

4.7 Multi-stim Mode

In multiple-stimulus modes, instead of an object being displayed in one position per trial, objects are displayed in two, three, or four positions simultaneously. The objects displayed are not identical, so the users have to keep track of which positions were occupied and also they have to keep track of which object occupied each position. By default, the stimuli are differentiated by color (blue is number 1, green is number 2, yellow is number 3, and red is number 4), though they can also be differentiated by image.

4.8 Interference

With a high interference setting, Brain Workshop will try to generate stimuli in a pattern designed to trick humans. If the amount of interference is set to 0.25, for example, then Brain Workshop will create a trick trial 25% of the time. Trick trials are where the current cue matches the cue either N-1, N+1, or 2N trials ago, but not the one N trials ago.
In multiple-stimulus modes, Brain Workshop will also occasionally take the positions for the different objects used N trials ago, swap them, and use those.

4.9 Configuration Options

Brain Workshop offers many options to tailor the program to your preferences. This is done by editing the config.ini file in the data folder. You can open the file in your default text editor from within Brain Workshop by pressing the letter "o" from the title screen. This file can also be found in Brain Workshop's data folder, located here:

- Windows: C:\Users\[username]\AppData\Roaming\Brain Workshop\data
- Mac: On Mac the config file is in "Library/Application Support/Brain Workshop/data" . The Library folder is in your home folder and is normally hidden.
- Linux: ~/.brainworkshop

The user can modify the option as they desire. For example, changing
WINDOW_FULLSCREEN = False to WINDOW_FULLSCREEN = True
will cause Brain Workshop to start in full-screen mode. If they'd prefer a black background instead of the default white background, set BLACK_BACKGROUND = True .Save the file and relaunch Brain Workshop to see your changes.
To see a list of all available options, open the default config file which will be created in the data folder when Brain Workshop is first launched.
If they wish to revert back to the default settings, simply delete the existing config.ini file in the data folder. The next time they will start the program, a new config file will be recreated with the default options.
Also they can specify a different config file than "config.ini" on the command line.
This feature comes in handy if more than one person is using Brain Workshop on a single user account. Each person can set their own configuration options and stats file.
A separate shortcut icon on the desktop can be created for each person.

To make multiple icons in Windows, they can follow this procedure:
Highlight the Brain Workshop icon and press Ctrl-C followed by Ctrl-V to rename the new icon.
Right-click on the icon and select Properties.
The users will see a field called Target that ends with: brainworkshop.exe"
After the final quotation mark, add the following: --configfile “something”.ini
Click OK.
Then launch Brain Workshop using the new icon. The config file will be automatically created in the data folder.
Optionally, open “something”.ini in a text editor and change the STATSFILE parameter in “something”.ini to point to a new stats file. The .ini will now be able to play Brain Workshop using its own configuration, session history and progress graph.

5.Other Non-Functional Requirements

5.1 Safety Requirements

To ensure that no one of Brain Workshop's users loses any data while using Brain Workshop (due to a crash or any kind of bug) the developer team uploads updates regularly. There is a bug tracker available where users can report any bugs they have encountered so that the developers can fix it in the next release.

5.2 Security Requirements

Brain Workshop does not have any security requirements and thus any type of user can use it without any additional privileges.

5.3 Software Quality Attributes

Brain Workshop provides the users with both simple and advanced features. Due to its well designed, easy to use interface and detailed Help section on their website it can be used by both experts and typical users.