DiViDu-next

User guide

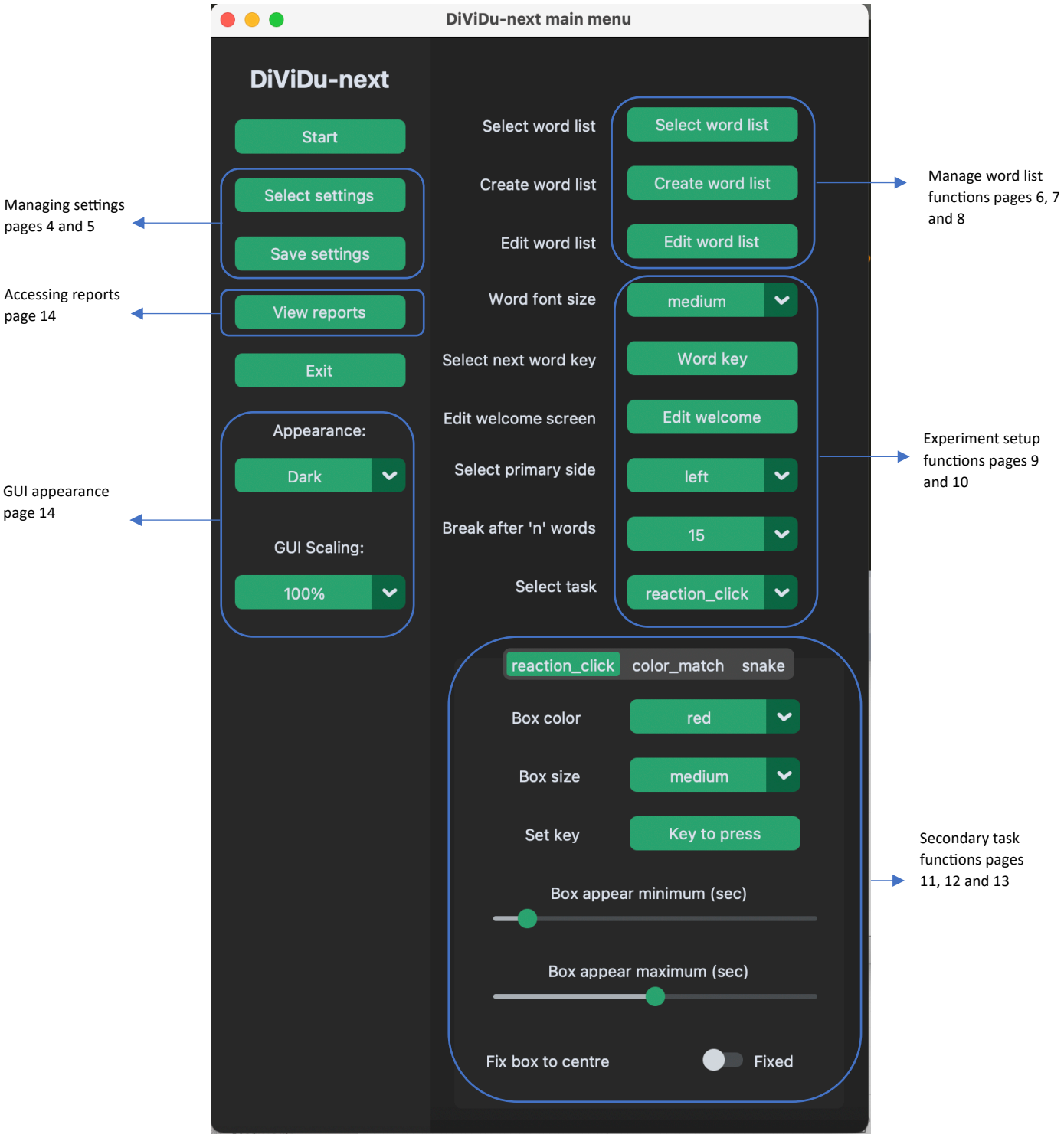
Background

DiViDu-next is software designed to provide a dual task experiment capability to test the cognitive effect of language on learning in computer science. The approach is based on the DiViDu software which is an open-source solution for Dual Task Experiments with Integrated Divided Visual Field Paradigm, created and published by Nina Heck and Moritz Schubotz [1].

The DiViDu-next is developed using the Python programming language and features OpenAI's Whisper transcription. The intent of this software is to test the cognitive effect of completing a primary task which comprises of verbally describing the meaning of computer science terminology and adding to the cognitive load by simultaneously completing a second task. The performance on the secondary task is captured during the experiment as a measure of cognitive load, and the subject's descriptions of the computer science terminology are also captured.

[1] Heck, N. and Schubotz, M. (2018) DiViDu – an open source solution for dual task experiments with integrated divided visual field paradigm, Journal of Open Research Software. Available at: https://openresearchsoftware.metajnl.com/articles/10.5334/jors.199 (Accessed: 13 June 2023).

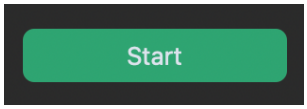
Part 1 - DiViDu-next User Interface



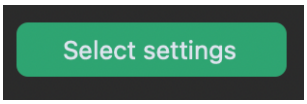
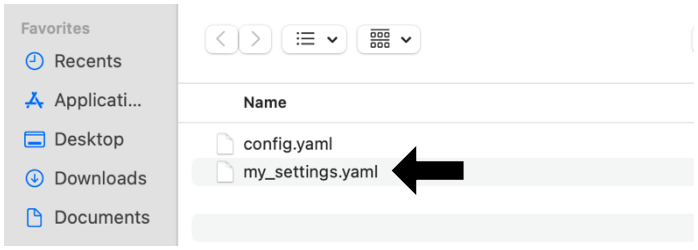
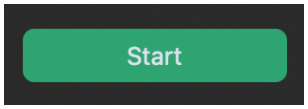
Managing experiment settings

The DiViDu-next software provides the function to save and retain ‘settings’ for the experiment for later reuse, if you choose not to adjust the settings the software will run on default settings provided within a file ‘config.yaml.

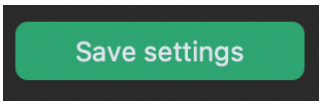
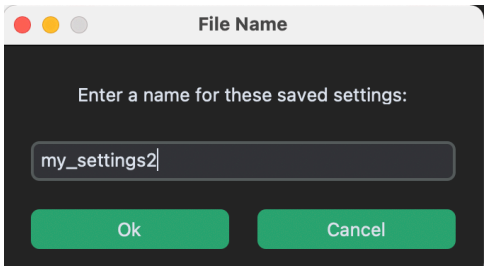
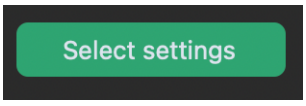
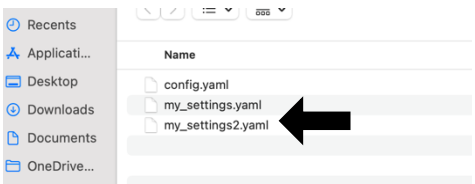
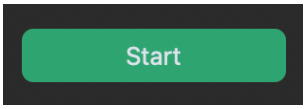
1. when the GUI is first opened the default settings are already selected and to run the experiment you can press start.

Item	Action
	Press “start” to start the experiment

2. If you have previously saved settings or wish to reset to the default settings, you must select them from the settings folder.

Item	Action
	Press “select settings”
	Navigate to the settings file you want to use and click on it to select and press “open”
	You will notice the GUI updated and you can press “start” to start the experiment.

3. If you change settings in the GUI, to use these settings in the experiment, first update the various settings on the GUI and to save and use these settings, select:

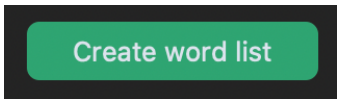
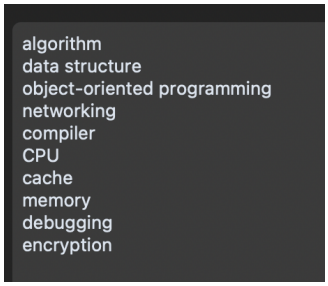
Item	Action
	Update the desired settings in the DiViDu-next GUI
	Press “save settings”
	Enter a name for your experiment and press “ok”
	Press “select settings”
	Select the settings file you have created
	Press “start”

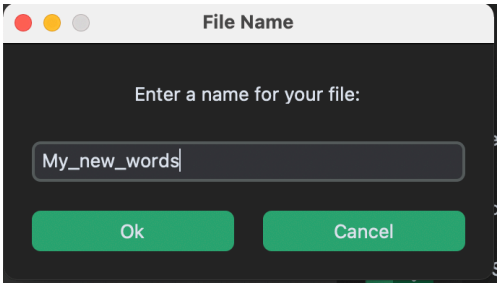
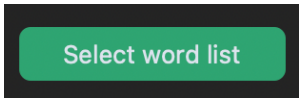
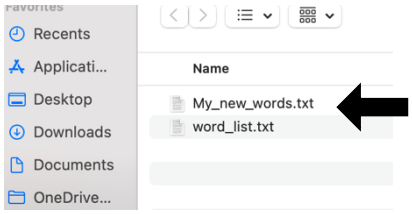
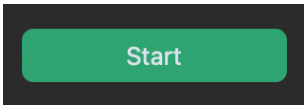
Manage the “word list”

The word list for the primary task can be updated and new word lists can be created. The word lists are saved as text files in a folder called “data”. When you open a new DiViDu-next GUI, the software uses the default word list named “word_list.txt”. If you immediately start the software this is the wordlist that will be used.

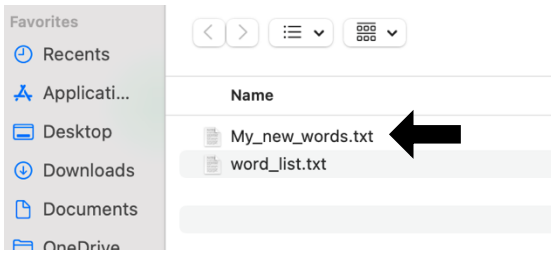
Note that the wordlist is randomized in the primary task and will not display in the order listed in the word_list.txt file.

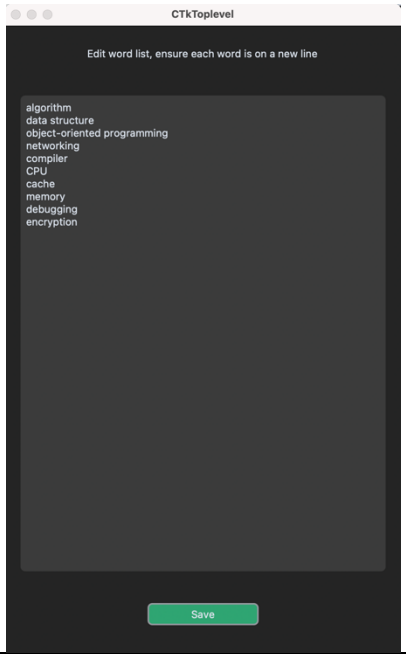
1. Creating a new word list:

Item	Action
	Press “create word list”
	Using the word list GUI, create your wordlist by placing each word on a separate line:  When finished click “save” to save the new wordlist.

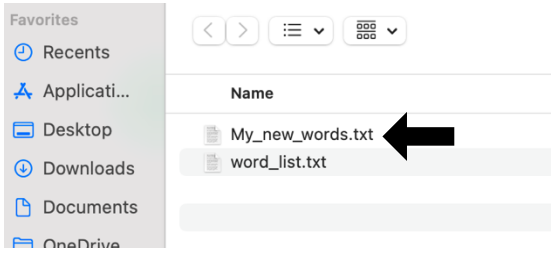
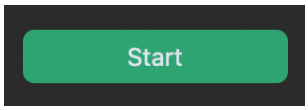
	Give your new word list a name and select “ok”.
	Press “select word list”
	Navigate to your new word list file and click on it to select and press “open”
	Press “start”

2. Editing a word list:

Item	Action
	Press “edit word list”
	Select the wordlist you want to edit and press “open”

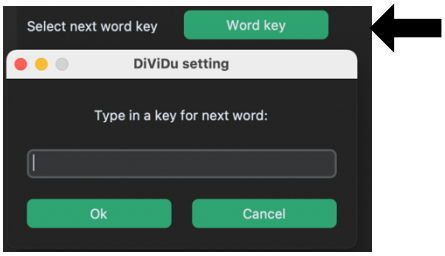
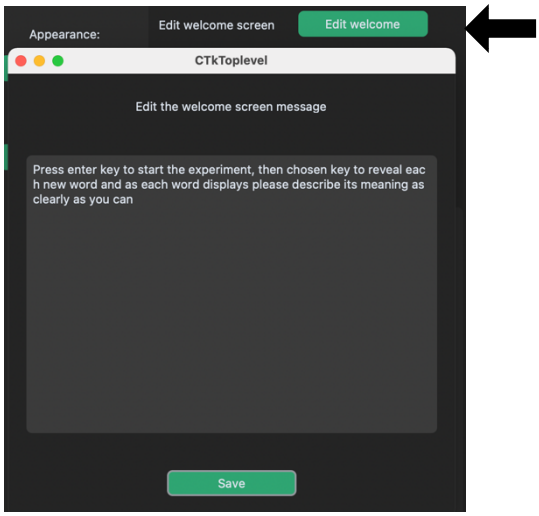
	Edit or add words to the word list, ensuring each new word is added on a sperate line. If you have a list of words in a word document, you can copy and paste these into the list. Once you have edited the word list click save.

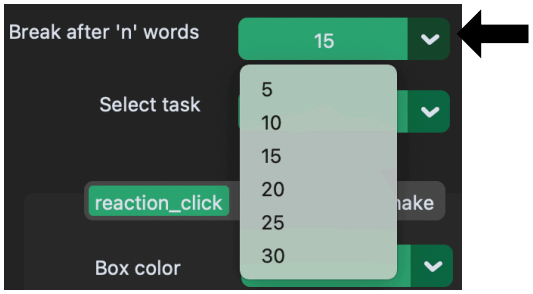
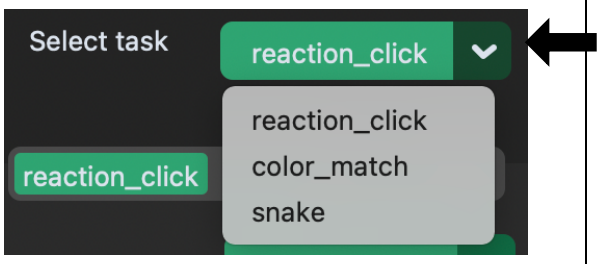
3. Selecting an existing word list to use in the experiment:

Item	Action
	Press “select word list”
	Select the wordlist you want to use and press “open”
	Press “start” to begin the experiment using this word list.

Experiment setup functions

Aspects of the DiViDu-experiment window can be adjusted through the GUI as follows:

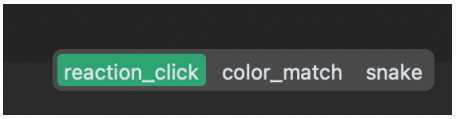
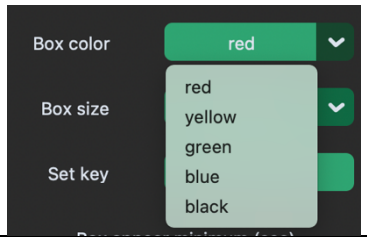
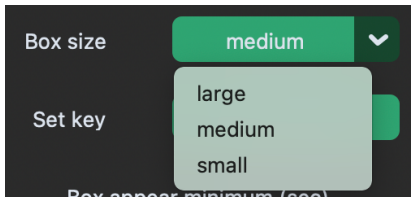
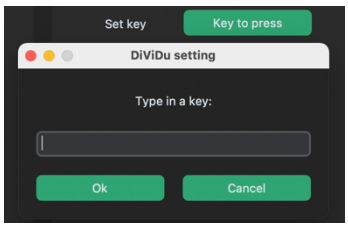
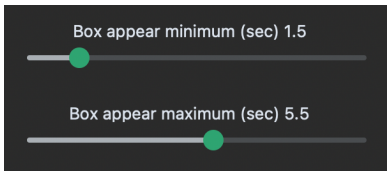
Item	Action
	Selecting the “word font size” allows the size of the words displayed in the primary task window can be adjusted to small, medium or large using the drop down list.
	Selecting the “word key” is used to change the keyboard key that is used by the test participant to progress through the word list. On pressing “word key”, enter your chosen key into the pop-up and press ok.
	Selecting the “edit welcome” allows the message displayed to the test participant before commencing the experiment to be edited. On pressing “Edit Welcome”, edit the text in the window and press “save” when finished.

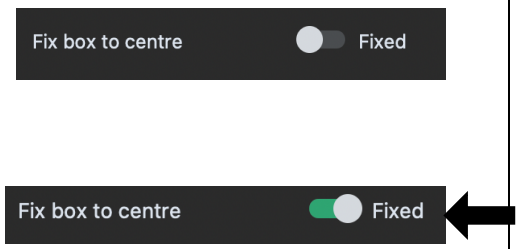
	The primary task is on the left side of the screen by default, this can be switched to the left of the screen by selecting “select primary side” and picking a side from the drop-down list.
	If working through a long list of words, it may be necessary to set a break. By using “Break after ‘n’ words” you can pick a number of words after which a break will occur in the experiment.
	Finally, but importantly, DiViDu-next provides the possible secondary tasks. The base secondary task is ‘reaction click’, however two further tasks “color match” and “snake” can be selected through “select task” you can pick which secondary task to use.

Secondary task functions

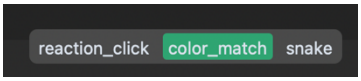
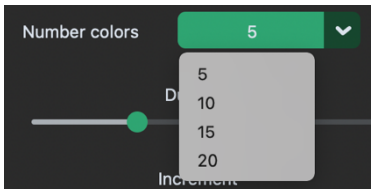
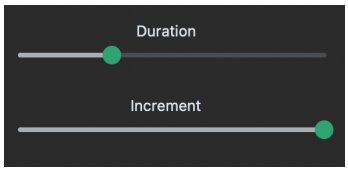
Aspects of the secondary tasks can be adjusted through the GUI as follows:

Reaction click task settings:

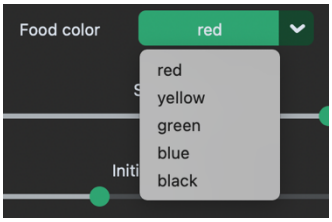
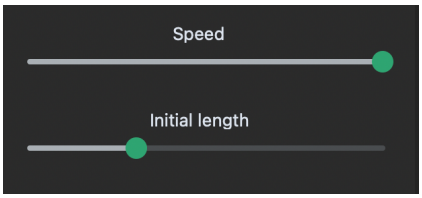
Item	Action
	Highlight “reaction_click” on the tab.
	Select “box color” to change the color of the box used in the reaction click task.
	Select “box size” to change the size of the box used in the reaction click task to either large, medium or small.
	Select “key to press” to change the keyboard key use to react to the box in the reaction click task. By default use the ‘l’ key (as in ‘l’ for lion)
	You can specify the appearance window for the box to appear after being dismissed. This can be set to appear from a minimum number of seconds to a maximum from being dismissed by using the slider bars.

	Finally, by default the reaction box appears in random locations in the secondary task window. The box can be fixed into place in the centre for a simpler task by using the “fix box to centre” switch.

Color_match settings:

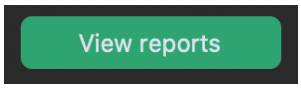
Item	Action
	Highlight “color_match” on the tab.
	The number of colors or range of colors selected from can be changed.
	These are placeholders for functions to be implemented.

Snake settings:

Item	Action
	Highlight “snake” on the tab.
	The food color can be changed.
	The speed that the snake traverses across the screen and the initial length of the snake can be adjusted using the slider bars to change the difficulty level of the snake task.

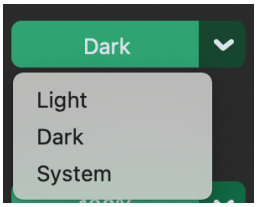
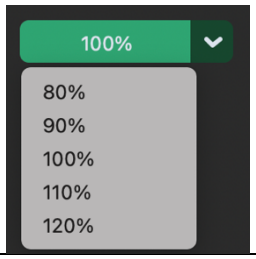
Viewing reports

Each time an experiment is run, the DiViDu-next software prompts for an experiment name. This name is used to identify the experiment output by placing the output files into a folder named after the experiment. The experiment reports can be accessed via the GUI as follows:

Item	Action
	Press “view reports” to access the reports
	Expand the folder for the particular experiment you are looking for, select the report and click open. Once open you can view the report or save a copy to another location for analysis.

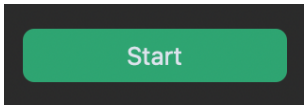
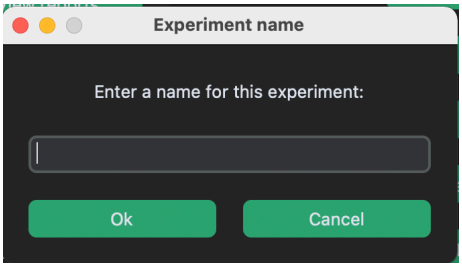
Changing the GUI appearance

You can change the GUI display to either a light or dark color scheme, and you can adjust the scaling to display optimally on your screen resolution:

Item	Action
	Select the appearance option and select, light, dark or system (your default system appearance setting)
	Select the scaling option and pick the scaling which best displays the GUI on your screen.

Part 2 – Experiment Instructions

1. Starting the experiment:

Item	Action
	See Part 1 on how to manage the experiment settings prior to starting the experiment. Start the experiment by clicking start.
	Before the experiment starts you are prompted for an experiment name. This name should be unique, if an experiment name is repeated, DiViDu-next will add a numeric suffix (e.g. _1) to identify the new experiment.

2. Welcome screen:

The welcome screen is presented to the experiment subject.

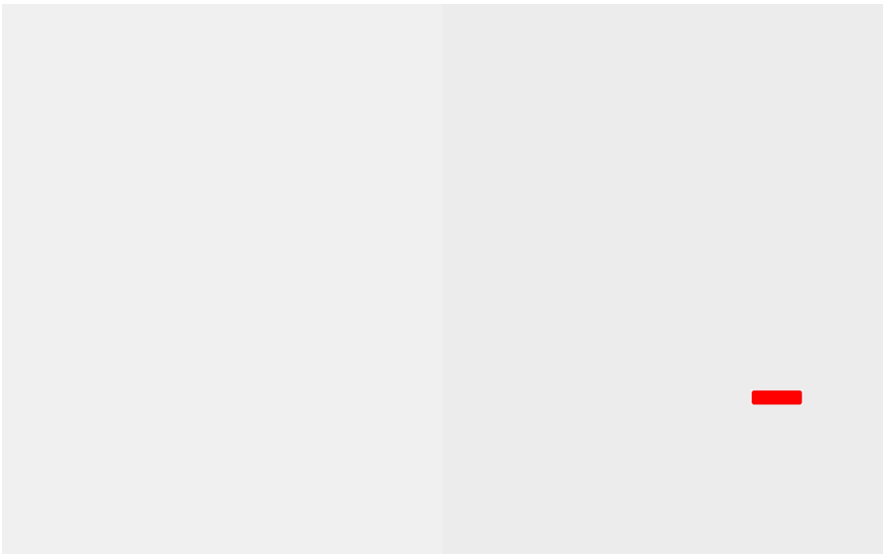
By default the welcome screen says:

“To start the experiment press enter. Press chosen key to reveal each new word and as each word displays please describe its meaning as clearly as you can”

This wording can be edited, see Part 1 for how that can be done.

3. When ready the test participant should be instructed to press the enter key to start the experiment. The default secondary task is ‘reaction click’. Instructions for ‘colour match’ and ‘snake’ provided later.

   The experiment window will be displayed.

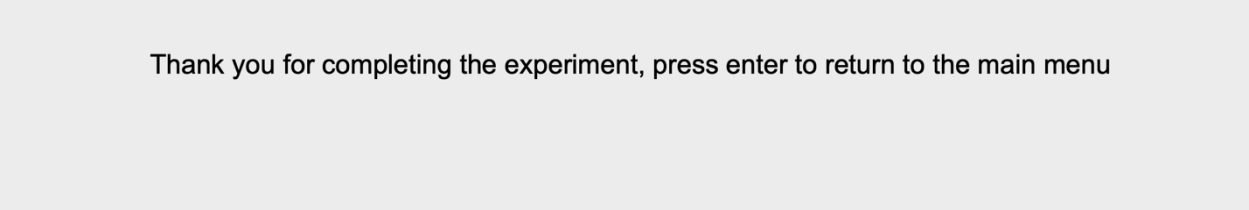


4. Initially the primary task is blank. The experiment will begin when the test participant presses the chosen key to reveal the first word. The default setting for this key is the SPACE bar. Pressing this key will reveal the first word.

5. A colored box will be displayed on the opposite side of the screen from the primary task word.

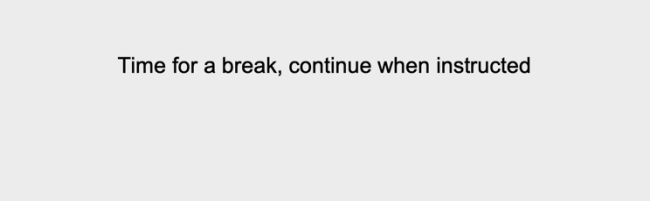
6. This is the reaction click task and the test participant must be instructed to press a chosen key every time they see this box appear whilst describing the word on screen. By default, the chosen key is the ‘l’ key (as in ‘l’ for ‘lion’). Each time the key is pressed the box will disappear and reappear randomly within a specified timeframe. See step 1 on how to adjust that timeframe.

7. The test subject should progress through all of the words through until the the below message is displayed.



8. Select enter and the window will close and the experiment will return to the main menu.

9. You may have set a break during the primary task, if this is the case, once the specified number of words have passed the test participant will be prompted on screen to take a break.



   To continue the experiment the test participant presses the ENTER key to resume the experiment.

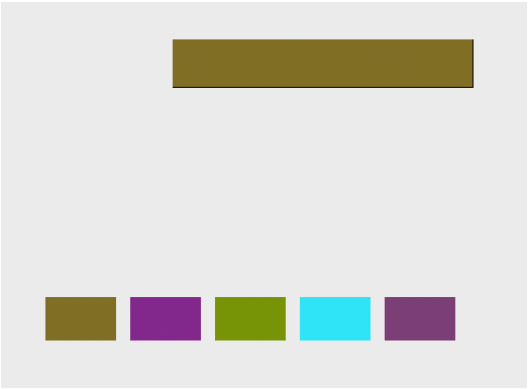
10. On completion of the task the DiViDu-next software will transcribe the test participants descriptions and save the audio file, the transcription and a CSV file containing the test participants reaction times from the secondary task. For instruction on how to view these reports see Part 1.

Color match and snake secondary tasks:

The experiment is performed following the same steps for the color match and snake secondary tasks, however, replace the reaction click task.

Color match:

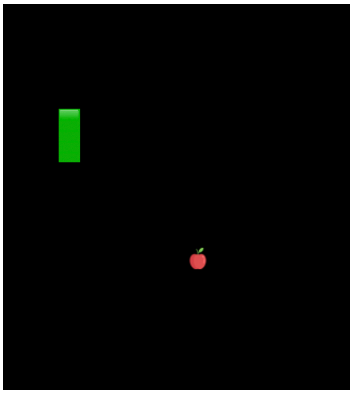
The color match task is performed by guiding the mouse to the small box that contains the same color as the large rectangular box. On clicking the box the main box will change color. The test participant should be provided a mouse for this task and asked to perform as effectively as they can while describing the primary task words.



The color match task

Snake:

The snake task is a well-known game where the snake is guided around the screen to eat the fruit, growing longer each time. The participant uses the up-down-left-right arrow keys to direct the snake around the screen. The test participant should be asked to perform snake as effectively as they can while describing the primary task words.



The snake task