

# Instructions for Use

## Simulation Program

The *Simulation* folder contains the Python program used for implementing, running and testing the agent. You can use it to reproduce the results presented in the paper. To do so you will just need to fill a number of fields in the “main” file to set the number of trials you want the agent to run, the numbers of series of steps in each trial etc..

For the papers’ first experiment, we used the following settings:

```
seriesOfSteps = [1, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768]
nbOfTrials = 50
openDoorAtStep = 65536
nbOfAdditionalTestSeries = 0
nbOfStepsInAdditionalTestSeries = 100
changeSoundLocsAtStep = 65536
```

For the papers’ second experiment, the parameters were the same, except :

```
openDoorAtStep = 2048
```

For the papers’ third experiment, the parameters were:

```
seriesOfSteps = [1, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024]
nbOfTrials = 50
openDoorAtStep = 2048
nbOfAdditionalTestSeries = 50
nbOfStepsInAdditionalTestSeries = 100
changeSoundLocsAtStep = 4548
```

To estimate the computing time, the parameters were:

```
seriesOfSteps = [2048]
nbOfTrials = 50
openDoorAtStep = 2048
nbOfAdditionalTestSeries = 0
nbOfStepsInAdditionalTestSeries = 100
changeSoundLocsAtStep = 4548
```

Once launched, the program will first create a directory called *Saved\_Files* in the *Simulation* directory, and then a number of sub-directories in *Saved\_Files*. It will then create the agent, run it and test it. This being done, you will find data, results and plots saved in the created directories. The most interesting are:

- *Plots* contains figures such as those presented in the paper (plus some others not shown in the paper).
- *Tables* contains a number of text files. Among them, *CorrectnessTable.tex*, *HitRatesTable.tex* and *PostLearningResultsTable.tex* are LaTeX code for tables such as those given in the paper. You just need to copy-paste them in the .tex document provided in the *Tablestex* folder in *Simulation* to get the tables.

The content of the other folders and files in *Saved\_Files* is as follows:

- *discrFunctions* contains text files with the outputs of some discriminative functions we use to “read” the connections of O- and A-neurons (for the last trial only). These functions play no role in the agent’s functioning and were not discussed in the paper, but they give an indication about which concept is encoded by which neuron, which can be useful to understand what is going on in the network.
- ‘*TestQuery*’ and *Tests\_NNs* contain text files with the result of tests that allow to monitor the neurons’ responses to inputs at the end of each series of steps (for the last trial only).

- *'learningActNeurons.txt'* lists which A-neurons have learned which action at which step (for the last trial only).
- *'performedActionstring.txt'* indicates which action has been performed and learned by which A-neurons at which step (for the last trial only).
- *'ResultData'* stores tests results' data, which are then used to produce tables and plots.
- *'Act2'* and *'Cnx'* store data from the neural network such as connexions, timing of spikes, etc.
- *'listsAndDicts'* stores data about the agent's universe, and is used for testing. Text files are readable versions of the data, which are printed to help analyzing the tests results.

To run the program you will need the following modules:

- *Numpy*
- *Random*
- *Time*
- *Pickle*
- *Mathplotlib*
- *Collections*
- *Os*

Research was carried out using Python with Spyder IDE.

- Spyder version: 6.0.5 (standalone)
- Python version: 3.11.11 64-bit
- Qt version: 5.15.8
- PyQt5 version: 5.15.9