## Configuration of the task

Configuration of the task is done by editing config.yaml file.

## Task’s instructions and messages

The task’s main instruction consists of .png files, which can be modified and replaced using respective source .pptx files (in the ‘images/EN’ folder).

To remove instruction screens or add new ones, you may modify the #INSTRUCTIONS section in main.py file by removing or adding respective lines of code containing the show\_image() function. In order to use a plain text instruction, provide a .txt file into ‘messages’ folder and load the file using show\_info() function.

Some messages displayed in the tasks are based on .txt files which can be modified in the /messages folder.

## Predefined experiments/tests – sets of trials

You may choose from several predefined sets of trials (located in /trials folder). Each set contains 12 training trials, as well as the respective number of experimental trials. Two categories of sets are provided:

**#1**

The following sets are suitable for psychometric purposes and are based on 44 unique trials used in Study1. Each set should allow to obtain a satisfactory variance of scores and reliability.

test20.csv – subset of 20 trials used in Study1 (~ 10 minutes)

test30.csv – subset of trials used in Study1 (~ 12 minutes)

test44.csv - trials validated in Study1 (~ 15 minutes)

test60.csv - trials used in Study1 + 16 additional trials (~ 20 minutes)

The trials in the above sets are provided in a progressive difficulty order by default but the order may be randomized in Config using the random\_trials\_order parameter.

Because each trial in the above sets is unique, the sets do not require providing additional randomization of spatial properties of the graphs (the random\_rotation/symmetry parameter in Conifg may be set False, though it can be set True if you wish so).

**#2**

The second category allows to control the difficulty of the trials while using full randomization. Therefore, it is suitable for experimental purposes. The following set includes trials used in a randomized experiment (Study2), in which three factors affecting difficulty were controlled in a 2x3x3 design:

* the perceptual difficulty of graphs (whether the graphs contains crossed edges or not)
* whether the target vertices can be identified directly by the unique degree of each target vertex or not (three types of trials)
* the number of edges in each graph

Please notice, that in the following sets the randomization of spatial properties needs of the graphs needs to be switched on to generate unique trials – **random\_rotation/symmetry parameter should be set True** when using the following sets.

exp54.csv – the trials from Study2; each of the 18 cells in the 2x3x3 design is represented by 3 trials (3x18=54), as the set includes 3 consecutive blocks of the same 18 trials.

In order to configure a different experimental design (for example manipulating only one or two chosen factors or reduced number of levels in a factor) please edit the exp54.csv file by removing/copying respective trials. Each trial in the file is described by its unique name reflecting its place in the 2x3x3 design, and the set of parameters (see the section Defining trials – trials’ parameters).

To simply increase or decrease the number of the block of trials, please copy or delete the blocks of trials in the file.

## Randomization

Three different types of randomization can be independently set in Confing using the three parameters:

* **random\_trials\_order** – random order of trials
* **random\_rotation/symmetry** – random transformation (rotation or mirror reflection) of the two predefined graphs in each trial. Each graph in a trial is with equal probability:

1. randomly rotated by 0/90/180/270 degrees

or

1. reflected in a random x/y/diagonal1/diagonal2 axis

Each resulting trial is a random variant of the predefined trial with unique positions of vertices in the graphs

* **random\_position** – random position (left/right) of graphs in each trial

Randomization affects only experimental trials, not training trials.

## Defining trials – trials’ parameters

The predefined sets can be modified and the new sets of trials can be created by modifying or creating new trials.

Each trial is defined by the following parameters:

* FEED – feedback displayed or not
* TRAIN – training or experimental item
* VA – provides positions (from 0 to 8) of vertices on a 3x3 virtual matrix of the A graph (the left graph):

0 1 2

3 4 5

5 7 8

* EA – list of ordered pairs defining edges between the given vertices of the A graph; bidirectional edges are made by providing two ordered pairs, for example (0,1), (1,0); **edges can only link neighbouring vertices** (e.g. 8 can be linked only with 4,5 and 7)
* left – defines a pair of corresponding vertices to be matched using the left mouse button; first digit in the pair reflects a vertex in the graph A, and the second digit reflects a corresponding vertex in the graph B;
* right - defines a pair of corresponding vertices to be matched using the right mouse button; first digit in the pair reflects a vertex in the graph A, and the second digit reflects a vertex in the graph B;
* Block – assigns the trial to a block; trials may be grouped into a single block of trials or into several blocks – randomization of the order of trials works on the level of blocks

The remaining columns are descriptive (their values do not affect the procedure):

* NV – number of vertices in each graph
* NE – number of edges in each graph
* Bidirectional – the number of bidirectional edges in a graph
* Type – type of a trial
  + DI – direct; the target vertices can be identified directly by the unique degree of each target vertex
  + InDI – the target vertices can not be identified directly by the unique degree of each target vertex; to identify the targets other vertices need to be first identified directly; more difficult type
  + mixed – only one target can be identified directly
* Crossed\_edges – whether the trial includes a graph with crossed edges, which increases the difficulty
* Name – name of the trial