## Configuration of the task

You may choose from several predefined tests (sets of trials located in /trials folder).

**#1 Predefined tests (default)**

The following tests are well suitable for psychometric purposes. Each test includes a number of unique, predefined trials presented in an order of progressive difficulty

* standard\_test44 – the validated test includes 44 trials (~ 15 minutes). The test should allow to obtain a satisfactory variance of normally distributed scores and a very good reliability. The test has been validated in a psychometric Study2
* test20– subset of 20 trials used in Study2 (~ 10 minutes)
* test30– subset of 30 trials used in Study2 (~ 12 minutes)
* test60 - trials used in Study2 + 16 additional trials (~ 20 minutes)
* easy\_40 – set of 40 trials with relatively lower level of difficulty
* hard\_40 – set of 40 trials with relatively higher level of difficulty

The order of trials can be randomized setting the “random trials order” parameter.

In addition, it is possible to randomize the order of graphs in each trial ( ) or/and provide random visual transformation (rotation or mirror reflection) of each of the two graphs in each trial. Selecting these two options allow to create a unique test for each running of the task (while keeping the difficulty level of each run fairly constant).

**#2 Randomized experiment**

This option is suitable for experimental purposes as it allows for the control of the complexity of the trials while using full randomization. The following option allows to control three parameters/factors:

* whether one of the graphs in a trial contains crossed edges or not (two types of trials)
* the number of edges in the graphs (3, 4, and 5 – three types of trials)
* whether the target vertices can be identified directly by the unique degree of each target vertex or not. Three types of trials:
  + direct; the target vertices can be identified directly by the unique degree of each target vertex; the easiest type
  + indirect – the target vertices cannot be identified directly by the unique degree of each target vertex; to identify the targets other vertices need to be first identified directly; the most difficult type
  + mixed – only one target can be identified directly

This allows to include only the selected levels of the factors, with the maximum of 2x3x3 design with all levels chosen.

By default, the order of trials is fully randomized. Importantly, all the graphs with the particular number of edges are isomorphic (are structurally the same graphs). This ensures that the graphs differ only by the selected factors. To ensure that the participants do not learn to recognize the graphs as isomorphic to types of randomization are used:

* random position (left/right) of graphs in each trial
* random transformation (rotation or mirror reflection) of each of the two 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

Because of the second type of randomization, each resulting trial is a random variant out of 64 (eight unique variants per one graph \* eight unique variants per second graph) possible variants of the generic trial predefined for each configuration of the three factor’s levels.

## Global options

These options refer to both Tests and Randomized experiments:

## Changing task’s instructions and messages

The task’s instruction consists of .png files, which can be easily 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.

## Advanced possibilities – defining new trials (graphs) and constructing custom tests

The predefined sets can be modified and the new sets of trials can be created by modifying or creating new trials. This can be achieved by modifying or creating new .csv files with lists of trials that can be than selected as new tests.

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

Each selection of vertices on the matrix is possible (each possible “shape” of the graph is allowed) – and the graph can include from 2 to 9 vertices.

* 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;

The remaining columns are purely 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 cannot 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