

UNV Assignment 5

Deadline: Submit report by week 13.

Topics: Stroop experiment

General guidelines for the assignment:

The aim of this assignment is to get acquainted with the methods used in behavioral studies of the functioning of the human brain and mind. Your assignment task will be to:

- 1) Slightly modify the experimental matlab script provided to you,
- 2) Collect the data on yourself, that is, the people in your group (as well as other family members and other members)
- 3) Analyze the data and prepare an experiment report.

The assignment has to be submitted in the form of a report (referát) following the guidelines listed below:

- **Format of the heading:** Include a header having an assignment title, names of students who worked on it (like in case of a project, you should work in max. 4 student's group), study year, group etc...

- **Format of the answers:** Firstly, the answer needs to be written in text format. Further, insert the MATLAB code/script relevant to the answer. Try to supplement with proper comments explaining your code. Sometimes the questions are freely stated in the assignment text. So, read it carefully, and make sure you answer all the questions.

- **Format of the figures:** The figures should be self-explanatory and include things like a legend (Example: What each colored line represents?), labelled axes with proper units. Further, use figure numbers and captions. Also, the text should contain description explaining the results shown in the figure. This could also include your evaluation/discussion whether the results in the figure are matching with your expected results.

- **Format of the document:** The report should be in a PDF format (use PDFCreator for instance). Send the report via email to **kogneuro@gmail.com** (note that this email id is different from the one on which I read standard emails). The subject of the email should have the following structure: UNV Zx author_names. (x- assignment number).

This assignment is based on J. Stroop's (1935) experiment illustrating the phenomenon of interference in cognitive processes (the article is available at <http://psychclassics.yorku.ca/Stroop/>, a description in Slovak is at www.percepcia.szm.sk/Stroop.html). Under interference, we mean that a certain cognitive process can be affected by a change in (for example, perceptual) parameters that are unrelated to the process. Specifically, Stroop has shown that the rate at which we are able to name the color in which a word is written (the font color) is lower if the color is inconsistent with the color spelled out by the word (ie, to determine that the following word "blue" is written in green takes longer than for the word "blue"). In this assignment, you will verify this effect in a short experiment. The aim of the assignment is to:

1. To learn how to perform experiments in MATLAB;
2. To familiarize you with the statistical methods used for data analysis; and
3. To give you the opportunity to practice, how to write articles describing such experiments.

You can find two MATLAB scripts in the <http://ics.upjs.sk/~kopco/UPJSONLY/unv/z5/> directory:

1. *expltr.m* MATLAB file with the training routine for the preparation of the experiment.

2. *expl.m* script to run the experiment itself and collect data.

Tasks:

1. Find 4 volunteers (or, if not possible, at least 2 in addition to you)
2. Each volunteer will participate in an experiment that has two phases – a training and the experiment itself,
3. Analyze the collected data, and
4. Write a report in which you evaluate your results.

In the lab we will explain the statistical procedures that you will use in the analysis. You can study them yourself from:

http://ics.upjs.sk/~kopco/UPJSONLY/unv/z5/tests_of_significance.pdf.

Training:

Before each experiment, everyone is trained to associate certain computer keys with on-screen colors. Colored squares will be presented during the training, and you must respond by pressing the appropriate key (c – blue, v – green, Space bar – brown, ‘,’(comma) – purple and ‘.’(dot) – red). While training, the system will tell you whether you've responded correctly, and the training continues for as long as you need until you respond correctly 15 times in a row with an average response duration of less than 0.8 seconds.

Experiment:

In the experiment itself, the task is the same, but instead of the colored squares appearing, the names of colors (always displayed in an incorrect color) or the text "xxxxx" will be shown. The task of the subject is to correctly determine the color of the text, not what is written on the screen. Trials when color names appear are experimental trials, while when we present the text "xxxxx" we are talking about a control presentation. The experiment consists of 120 trials.

Data Analysis:

At the end of the experiment, the *expl.m* script generates a MATLAB data file *stroop_deň_hodina_minúta.mat*, where the subject's responses (i.e., the participant of the experiment) are recorded. This file is loaded in MATLAB by the *load* command. After loading, two variables appear in MATLAB, one of which is called *trial_data*. This is a two-dimensional matrix, each row of which corresponds to the record from one trial (i.e., it has 120 rows). The meaning of the columns is as follows:

1. Code of the presented text (0-xxxx, 1-blue, 2-green)
2. Trial color code (1-Blue...)
3. Correctness of the answer: 1 - correct, 0 - incorrect
4. RT (response time): time (in seconds) it took the subject to respond to the trial

For each individual, make the following analysis (the statistical concepts will be explained in the lab), including only those measurements where the answer is correct:

a) Calculate the mean value (arithmetic mean) and the median of the reaction times separately for the experimental and control trials (use the commands *mean*, *median*) in MATLAB. Which statistical measure is more appropriate? Also calculate the standard deviation of reaction times for these two types of trials.

b) Generate an image showing the distribution of reaction times in control and experimental trials (use commands *hist*, *plot*, *axis*, *xlabel*, *legend*, *title*) with different symbols in the same graph; Also generate aggregate graphs that indicate the average values of the analyzed parameters for the whole group.

Using the "Student t-test", decide whether the difference in reaction times between experimental and control trials is statistically significant (at $\alpha = 0.05$, MATLAB function *ttest*), separately for the mean values and for the medians. Attach the MATLAB code you used to analyze the data.

Report:

You will describe the experiment result in a report (a text document(PDF) uploaded in electronic or printed form) containing at least the following parts:

- **Introduction** - A brief description of goals
- **Methods** - description of the methods used in the experiment
- **Results** - presentation of results
- **Discussion** - Discussion of experiment results

Additional tasks (extra 10% bonus credit):

If you want to play more with this experiment, you can try to:

- Modify the experiment so that control trials do not show "xxxxx" but the correct color text. Did the results change somewhat in comparison to the original version?
- Calculate the mean value and the median of the probability of the correct response instead of the reaction time analysis.
- Analyze data separately for each color. On average, at the presentation of which color the reactions were the fastest and slowest?
- Draw how the percentage of errors and reaction times have changed during the duration of the training (i.e. as a function of a training block)

By doing the above additional tasks you can earn an extra 10% credit.

All the best!! Have fun 😊