# Visual Search Experiment

Computers and Cognitive Sciences I assignment, 2022/23

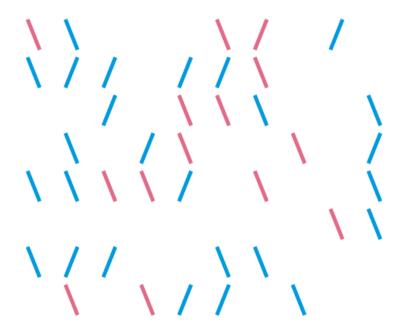
## Study

In this assignment, you will measure the efficacy of **visual search**. Your participants will be searching a screen for a particular shape, and you will test how various factors affect their speed. Visual search has been studied since 80's. In the experiment, we will focus on the effect of set size (how many objects on the screen), target presence and homogeneity of the set (if the objects vary in one or two features).

• To familiarize with the terminology and common research question, read the text on http://www.scholarpedia.org/article/Visual search

# **Preparations**

The experiment is collected in the browser and is available at <a href="https://visionlabels.github.io/library/experiments/visual-search-mff.html">https://visionlabels.github.io/library/experiments/visual-search-mff.html</a>
It is programmed using <a href="mailto:jsPsych">jsPsych</a> library – you can check the code, but it is not important here. Your task it to search for <a href="mailto:jpink">pink</a> / among pink \ (or pink \), blue \ and blue /).



[f] Present or Absent [j]

There are 16 combinations of conditions, each is repeated 20 times:

# pink /	# blue /	# pink	# pink /	Target	Set size	Search type
1	0	9	0	Present	10	Feature
1	0	19	0	Present	20	Feature
1	0	29	0	Present	30	Feature
1	0	39	0	Present	40	Feature
0	0	10	0	Absent	10	Feature
0	0	20	0	Absent	20	Feature
0	0	30	0	Absent	30	Feature
0	0	40	0	Absent	40	Feature
1	3	3	3	Present	10	Conjunction
1	6	6	7	Present	20	Conjunction
1	10	10	9	Present	30	Conjunction
1	13	13	13	Present	40	Conjunction
0	3	3	4	Absent	10	Conjunction
0	7	7	6	Absent	20	Conjunction
0	10	10	10	Absent	30	Conjunction
0	13	13	14	Absent	40	Conjunction

• Try the experiment yourself.

Notice, how much time you need to familiarize yourself with the task. Try to be both fast and accurate. You get feedback after each trial (plus feedback about time if your response is slower than 2 seconds). There is no training or break, but you can introduce them for your participants. For training, you can start the experiment and reload it after 10-20 trials. For break, you can allow the participant to make a short break – they will be warned about the long response, just remove this long trial from your analyses. Notice, the data are saved locally into the CSV file.

• Check the content of the CSV file.

#### Data collection

You will need the data from N=3 other people (not you). Unless there is a new wave of covid, try to be present during the experiment. Find a calm place where you can collect the data. Turn off the phone, turn off computer notifications. Sometimes people are tired/ill (work definition: if able to drive, you can collect data). Explain experiment in your own words.

• Collect the data of 3 other people

## **Analysis**

Your data probably something like this:

A	В	C	D	E	F	G	H	1	J	K	L	M
			trial_index	time_elapsed	internal_node_id	response	present	setSize	conjuction	task	correct	stimulus
[{"page_index":0,"viewing_tir	5205	instructions	0	5205	0.0-0.0							
	3221	canvas-keyboard-response	1	8937	0.0-1.0-0.0	j	false	30	) false	response	true	
	null	html-keyboard-response	2	10447	0.0-1.0-1.0	null						Correct! br> br> <bbwork b="" faster!<=""></bbwork>
	766	canvas-keyboard-response	3	11724	0.0-1.0-0.1	f	true	30	true	response	true	
	null	html-keyboard-response	4	13237	0.0-1.0-1.1	null						Correct!
	544	canvas-keyboard-response	5	14289	0.0-1.0-0.2	f	true	10	false	response	true	
	null	html-keyboard-response	6	15798	0.0-1.0-1.2	null						Correct!
	459	canvas-keyboard-response	7	16764	0.0-1.0-0.3	f	true	10	true	response	true	
	null	html-keyboard-response	8	18272	0.0-1.0-1.3	null						Correct!
	576	canvas-keyboard-response	9	19353	0.0-1.0-0.4	f	true	40	false	response	true	
	null	html-keyboard-response	10	20859	0.0-1.0-1.4	null						Correct!
	571	canvas-keyboard-response	11	21940	0.0-1.0-0.5	f	false	20	true	response	false	
	null	html-keyboard-response	12	23448	0.0-1.0-1.5	null						Wrong
	931	canvas-keyboard-response	13	24885	0.0-1.0-0.6	j	false	10	) false	response	true	
	null	html-keyboard-response	14	26392	0.0-1.0-1.6	null						Correct!
		[{"page_index":0,"viewing_tin 5205 3221 null 766 null 544 null 459 null 576 null 577	[("page_index":0,"viewing_tii 5205instructions 3221 carvas-keyboard-response null html-keyboard-response 766 carvas-keyboard-response html-keyboard-response 544 carvas-keyboard-response html-keyboard-response 459 carvas-keyboard-response null html-keyboard-response 757 carvas-keyboard-response 571 carvas-keyboard-response null html-keyboard-response 931 carvas-keyboard-response	view_history         rt         trial_type         trial_index           [{*page_index**:0,*viewing_tiri*         5205instructions         3221_carwas-keyboard-response         1           null         html-keyboard-response         2           766:carwas-keyboard-response         2           null         html-keyboard-response         4           s44:carwas-keyboard-response         5           null         html-keyboard-response         7           null         html-keyboard-response         7           fcarwas-keyboard-response         9         10           571:carwas-keyboard-response         11           null         html-keyboard-response         11           null         html-keyboard-response         12           931:carwas-keyboard-response         12	view history         rt         trial_type         trial_index_time_elapsed           {\( \) page_index^*:0, viewing_tip*         5205 instructions         0         5205           3221 carwas-keyboard-response         0         5205           null         html-keyboard-response         2         10447           766 carwas-keyboard-response         3         11724           null         html-keyboard-response         4         13237           544 carwas-keyboard-response         5         14289           null         html-keyboard-response         7         1676           null         html-keyboard-response         7         1676           null         html-keyboard-response         9         1935           null         html-keyboard-response         10         20859           571 carwas-keyboard-response         11         21940           null         html-keyboard-response         12         23448           931 carwas-keyboard-response         12         23485	view_history         rt         trial_type         trial_index         time_elapsed internal_node_id           [{*page_index**:0,"viewing_tim**} 5:205 instructions         3221canwas-keyboard-response         0         5205:00-0.0           3221canwas-keyboard-response         1         8937:00-1.0-0.0           1mill         html-keyboard-response         2         10447:0.0-1.0-0.1           766 carwas-keyboard-response         3         117240.0-1.0-0.1           1mill         html-keyboard-response         4         13237:0.0-1.0-1.1           459 carwas-keyboard-response         6         15798:0.0-1.0-1.2           459 carwas-keyboard-response         7         1676:40.0-1.0-0.3           1mill         html-keyboard-response         9         1935:30.0-1.0-0.4           1mill         html-keyboard-response         10         2085:90.0-1.0-1.1           576 carwas-keyboard-response         10         2085:90.0-1.0-1.5         1           1mill         html-keyboard-response         1         21940:0-1.0-0.5           1mill         html-keyboard-response         11         21940:0-1.0-0.5           1mill         html-keyboard-response         12         23448:0.0-1.0-0.5           1mill         html-keyboard-response         12         2348:0.0-1.0-0.5	view_history         rt         trial_type         trial_index_time_elapsed_internal_node_id_response           [(*page_index**:0,"viewing_tin*_5205 instructions         3221canvas-keyboard-response         0         5205:0,0-0.0           null         html-keyboard-response         1         8937.0,0-1,0-0.0         j           766carvas-keyboard-response         2         10447.0,0-1,0-0.1         ntl         f           null         html-keyboard-response         4         13237.0,0-1,0-1,1         null         null	view_history         rt         trial_type         trial_index_time_elapsed_internal_node_id_response         response_present         present           [{*page_index**:0,"viewing_times_5205_instructions         3221canvas-keyboard-responses         0         5205_00.00.0         )         j false           null         html-keyboard-response         2         10447_00.01.00.1         null         html-keyboard-response         3117_240.01.00.1         null         ftrue           null         html-keyboard-response         4         13237_00.1.01.1         null         null         true           null         html-keyboard-response         6         15798_00.1.0.1.2         null         null           null         html-keyboard-response         7         1676_40.01.0.0.3         ftrue         true           null         html-keyboard-response         9         1935_30.0.1.0.1         null         true           null         html-keyboard-response         9         1935_30.0.1.0.0.4         ftrue         true           null         html-keyboard-response         10         2085_90.0.1.0.1.5         null         true           null         html-keyboard-response         11         21940.0.1.0.0.5         f         ftrue           10         10	view history         rt         trial type         trial index         time_elapsed internal node_id         response         present         setSize           [{**page_index**0,*viewing_tim**} 5:205 instructions         3221 carwas-keyboard-response         0         5205 0.0-0.0         )         false         33           null         html-keyboard-response         2         10447 0.0-1.0-1.0         null         null         html-keyboard-response         3         11724.0 0.1-0.0-1         frue         33           null         html-keyboard-response         4         13237 0.0-1.0-1.1         null         null         null         true         1           null         html-keyboard-response         5         14289 0.0-1.0-1.2         null         null         true         1           null         html-keyboard-response         6         15798 0.0-1.0-1.2         null         null         null         true         1           1         10         10         10         10         10         10         1	view_history         rt         trial_type         trial_index_time_elapsed_internal_node_id         response_present         present_setSize         conjuction           [[*] page_index**:0,"viewing_tim*         5205 instructions         0         5205:0,0-0.0         )         false         30 false           null         html-keyboard-response         1         8937.0,0-1,0-0.0         )         false         30 false           766carvas-keyboard-response         2         10447.0,0-1,0-0.0         ntrue         10 true         30 true           null         html-keyboard-response         4         13237.0,0-1,0-1.1         null         null         true         10 false           null         html-keyboard-response         6         157980.0-1,0-1.2         null         null         null         10 true         10 true         10 true           1         10 false         10 20859.0-1,0-1.2         null         null         10 true         10 tr	view history         rt         trial_type         trial_index_time_elapsed internal_node_id_response         response         testSize_conjuction         task           [{**page_index**:0,*viewing_time_source_index**:0,*viewing_time_sour	view_history         rt         trial_type         trial_index_time_elapsed_internal_node_id_response         present_setSize_conjuction_task         correct           {(**page_index**:0,"viewing_tim_stops_tim_st

Notice some of the columns are not important for our analysis. Also, about half of the rows comes from the feedback trials, which we should also discard.

- Create a clean dataset with only the data you need. Put all participants together into a single table but create a new column Participant and use unique code for each of them. Don't use real names or initials.
- Import the data to the statistical program (e.g., R).
- Report the accuracy (percentage of errors for each participant). Remove the error trials for the subsequent analyses.

You will need to create a regression model predicting rt based on set size, search type (feature/conjunction) and target presence. People use the regression slope for set size as a measure of efficiency.

- Report the slope and its confidence interval both for feature and conjunction search (when target present). Do they differ?
- Calculate slope for the target absent trials. Do they differ from the respective target present trials? Why? How many objects do you need to check on average for both cases?

Note: We have only limited sample size. In a real experiment, you would test 20 to 40 people to get reliable estimates. Nevertheless, people differ in their performance, and you probably need to address this. If you have only 3 participants, compare their response times and slopes (is there some major difference?). You do not need to report statistical difference for this, just address this with table or a text paragraph. To treat the individual differences statistically you can normalize the response times by the individual mean, add the participant to regression or use <u>linear mixed models</u>.

## Report

Write a brief report about what you measured and how. Suggested structure:

- 1. What is Visual Search (about 1/2 page)
- 2. Describe the experiment (1/2 to 1 page) describe the task, describe your setup (screen size and resolution),
- 3. Results (about 1 page) what you found out, descriptive statistics, pick suitable charts (e.g., 3 charts)
- 4. Conclusions (1/2 to 1 page) your interpretation (what you found and what was expected), your explanation/suggestion why this happened.

Keep the report below 4 pages.

 At least 7 days before the exam/meeting send your report (PDF) and zipped data and code to jiri.lukavsky@ff.cuni.cz