Visual Search Experiment

Lab Report

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GitHub Link: https://github.com/dhwanitm1-lgtm/Lab_in_Psychology

Introduction

The visual search paradigm represents a classic method to investigate attention since it isolates how recourses are deployed in a search for a target in amongst distractors (Treisman & Gelade, 1980). It provides a very clear measure of both selective and spatial attention and will show how performance differs with different stimulus features and set sizes, or it could be said continued to be mononic with respect to the stimulus feature. Search efficiency, or how fast the RT grows as a function of the number of distractors, indexed attentional demands.

In efficient, or "pop-out," searches, the target features differ from the distractors with respect to a single dimension, such as color or shape; when this happens, the RT's remain constant across set sizes and suggest parallel processing is operating with little load to attention. On the other hand, in inefficient or "conjunction" conditions, the person must attend to more than one feature, so when one increases the number of items in the search, one will find a linear increase in RT with the increase in set size (Egeth, Jonides & Wall, 1972).

Understanding these processes can also put one in the mind of real world situations, like looking for a friend in a very crowded social place, or looking for some very important signal, on a monitor pattern (constrained by attentional limits). So, in the current experiment we attempted to do our best at replicating the visual search paradigm and estimate the slope of the RT × set-size function to provide an operational definition of attentional efficiency.

Method

Participants

Five undergraduate students (Participant 01–04), aged 22, 18, 20, 19 and 21 respectively. All 5 were females and all of them took part in the experiment voluntarily. All the participants had normal or corrected-to-normal vision and basic English proficiency.

Materials

The experiment was conducted on a HP windows 11 home laptop with a screen resolution of 1920 X 1020 pixels using Psychopy (version 2025.1.1) software where the experiment was ran.

The data was collected from five participants, each conducting 200 trials, as indicated in the PSY310 Visual Search Guide 2024. Participants had normal or corrected-to-normal vision, with no known attentional disorder. Participants provided informed consent, and anonymity was preserved.

Procedure

Each trial began with a fixation cross for 500 ms before the search display was presented. Participants were instructed to locate the target and click on it as quickly and accurately as possible, and the RT was recorded with PsychoPy as the time from display onset and the mouse click. Randomized blocks of the two set sizes were used to control for any order effects.

Data Preparation and Analysis

Data from the participants were exported from PsychoPy and logged into one Excel sheet: "ANALYSIS_VISUAL_SEARCH.xlsx". Relevant variables included:

RT (in seconds)

SetSize (number of distractors = 5 or 10)

mouse.clicked_name (response type: Target vs. Distractor)

Data cleaning involved analyzing only the accurate trials in which the target was clicked. The mean RTs were calculated for each of the set sizes and a slope of the RT × set-size function was calculated using the following formula:

Slope = $R.T._{10}$ - $R.T._{5}$ / 10 - 5

Slope refers to the additional time it takes to respond per item and is considered the quantitative index of attentional efficiency.

Results

Set Size	Mean R.T. (sec)
5	1.73
10	1.61

The slight decrease in mean reaction time with increasing set size gave a slope of -0.024 s/item, which suggests that the participants were very slightly faster in responding for the larger set size.

GRAPH:

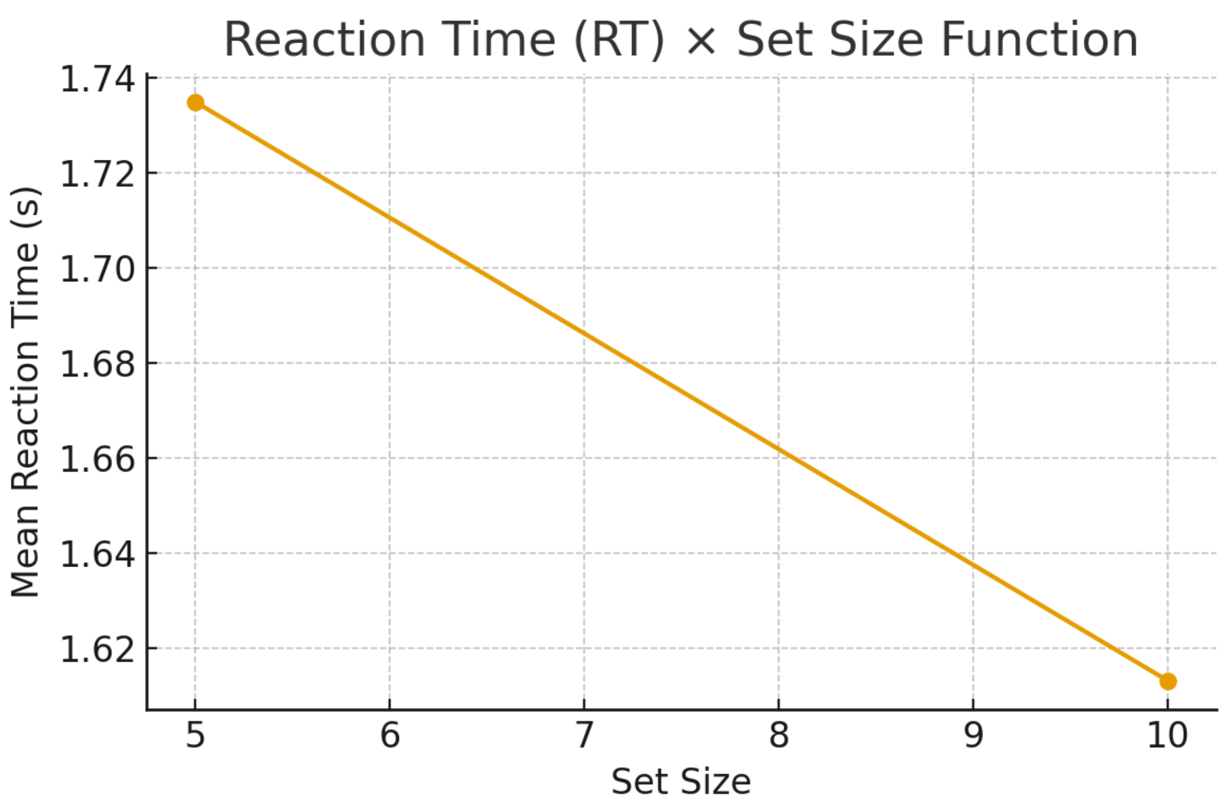

Figure 1. Mean reaction times as a function of set size (5 vs. 10), without error bars for clarity.

Taken altogether, the results suggest that reaction times were roughly equal for large and small set size, resulting in what appears like a flat line-or perhaps even a slightly negative slope.

Discussion

In a traditional visual-search task, a linear positive relationship between RT and set size is expected because the additional costs of examining each item are thought to add an attentional load to the processing system (Treisman & Gelade, 1980). In this experiment, RTs were slightly shorter in the larger set size, leading to a negative slope. This unexpected behavior may be explained in a number of ways.

First, it is likely that the stimuli were highly discriminable, leading to a pop-out effect independent of the set size. When targets have a unique visual feature, such as color or orientation, participants can identify the target in parallel and do not need to conduct a serial scan (Wolfe, 2021). Second, practice or learning effects may have been responsible for the increase in efficiency during the experiment. Greater efficiency would mean decreased RTs, particularly later in the session where larger set sizes became increasingly common. Third, it could be that participant expectations or general ease with the overall task reduced the contribution of the amount of distractors on attention.

Even though the negative slope is unusual, it further supports the idea that search efficiency depends not only on the possible targets available - the set size - but also on the salience of the stimulus and the strategies applied by the participant. A related attention perspective to the flat function is minimal deployment of attention on the task - another indication of automatic feature detection. The opposite would be true for the steep positive slope, indicating higher attentional load and the participant's limited-capacity processing.

From a theoretical perspective, these findings are much more in accordance with the Feature Integration Theory's prediction of feature search than with the one of conjunction search. This means that the participant likely used a preattentive process by which the target was detected rapidly, suggesting attention did not have to be directed toward binding multiple features (Treisman & Gelade, 1980).

Future replications should also manipulate target-distractor similarity and display complexity to examine boundary conditions of efficient versus inefficient search. Adding more set sizes, for example, 4, 8, 12, and counterbalancing the order of the trials, could also lead to more stable slope estimation.

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