Visual Search Experiment

INFORMATION FOR INSTRUCTORS

**Purpose of this Project:** After completing this project, your students should understand why it is difficult to find a needle in a haystack! The should also have a better understanding of the difference between independent variables and dependent variables, as well as the use of t-tests to test the effect of an independent variable on a dependent variable. This project also provides a good opportunity to review the difference between *serial processing* and *parallel processing* and the use of *reaction time* as an index of cognitive performance.

**Preparation for Data Collection**

1. Distribute the Visual Search Data Sheet to each student. Explain that this project is an experiment on how we locate a target in the midst of distractors. Do NOT describe Treisman’s distinction between single-feature search and conjunctive-features search at this point or discuss the hypotheses for this experiment.

2. Explain that the experiment will require them to search for an orange square (the target) on a screen that contains some combination of blue and orange squares and triangles, and that they should try to respond as quickly as they can without making errors. Students will receive their own individual results the end of the experiment. They should copy those results onto their data sheet and should then graph their performance in the top graphs on the data sheet.

3. Tell students how they can access the link to the Visual Search Experiment on the ***Psych Labs*** website. Establish a due date for completing the experiment and announce a date when the pooled results will be available.

4. Explain that, when the pooled results become available, students should copy the group results for use in their Lab Report and graph the pooled results in the bottom graphs on the data sheet.

**Statistical Analysis Instructions:**  At your discretion, you may choose to perform the statistical analysis and provide your students with a summary of the results in a handout, or assign students to perform the statistical analysis on their own, with guidance provided by the you in a class setting or via a handout with detailed steps to follow in order to complete the analysis.

If the results from your students are similar to those obtained from other students in the past, you should expect this pattern of results:

* RT will be faster overall on Feature Search trials than on Conjunctive Search trials
* RT will be faster overall on trials with 4 objects than on trials with 16 objects
* RT on Conjunctive Search trials with 16 objects will be much slower than with 4 objects, while RT on Feature Search trials with 16 objects will be only slightly slower than with 4

**Background Readings:** Three readings (all in PDF format) have been provided on the ***Psych Labs*** website. The first reading is the Wikipedia entry on “Visual Search”, which provides a clear and helpful introduction to the topic, and to Treisman’s Feature Integration Theory. The second reading is the classic article by Treisman and Gelade (1980) that forms the basis for this Psych Labs experiment. It is a lengthy article, so you may want to assign only portions of the article. The last reading (Nakayama & Silverman, 1986) is a short journal article describing a follow-up experiment on visual search.

In addition, you should direct your students to read the appropriate material about dual processing (conscious vs. unconscious and serial vs. parallel processing), selective attention (and the pop-out phenomenon, if covered), and gender similarities and differences (in cognitive abilities) from the textbook you are using.

Myers, D. G., & DeWall, C. N. (2021). *Psychology: Thirteenth edition in modules.* New York: Worth Publishers.

Nakayama, K., & Silverman, G. H. (1986). Serial and parallel processing of visual feature conjunctions. *Nature, 320,* 264–265.

Treisman, A. M., & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive Psychology, 12,* 97-136.

Visual search. (n.d.). In Wikipedia. Retrieved June 13, 2012, from http://en.wikipedia.org/wiki/Visual\_search

**Instructions for Writing the Lab Report:** At your discretion, you may choose to have students write and submit a full typed lab report using the *report template* document, or have students prepare a simpler lab report by typing their answers to the questions posed in the *report worksheet* document. In either case, before they begin writing the report, they should have 1) the statistical results from the pooled data, and 2) guidelines for the report from you in the form of a report template or a worksheet.

The following summary should help you answer student questions about the experimental design, the hypotheses, and the statistical analyses.

**Independent Variables**

* Search Type: Feature vs. Conjunctive
	+ Feature search occurs when a single perceptual feature (shape, color, size, orientation, etc.) is sufficient to distinguish the target from the distractor objects, as in the case of an orange square among blue squares.
	+ Conjunctive search occurs when the target shares one or more perceptual features with the distractor objects, and only the conjunction of two features (e.g., shape plus color) distinguishes the target from the distractors, as in the case of an orange square among blue squares and orange triangles.
* Number of Objects: 4 vs. 16

**Dependent Variables**

* Response Speed (RT in msec) – lower = better = faster performance
* Response Accuracy (PC/percent correct) – higher = better = more accurate performance

**Hypotheses**

* H1 – Search Type: Feature search will be faster than Conjunctive search
* H2 – Number of Objects: Searches with 4 objects will be faster than searches with 16 objects
* H3 – Interaction of Search Type and Number of Objects: This interaction will be significant; adding more objects will slow Conjunctive Search (because objects need to be examined serially), while adding more objects will have little effect on Feature Search (which can use parallel processing)

Note: All hypotheses involve speed only, but the pattern should be similar for accuracy.

Rationale for H1 and H3: Treisman’s *Feature Integration Theory* (FIT) claims that Feature Search can use parallel processing (which explains why the target “pops out” from the surrounding objects), so it is not influenced very much by the number of distractor objects. In contrast, Conjunctive Search requires serial processing, so reaction time increases as the number of distractor objects increases. The difference between parallel and serial processing should produce a main effect for search type as well as an interaction between search type and number of objects (significant simple main effect for Number of Objects for Conjunctive Search but not for Feature Search).

Sample Response Screen



**Statistical Analyses**

Given the design, the appropriate analysis would be a 2 x 2 repeated-measures ANOVA. However, for an introductory psychology laboratory experience, this project is set up so that the results can be analyzed with a series of four t-tests (which assume a significant interaction). If you want your students to analyze the data, show them how to download the raw data and open the data .CSV file in a spreadsheet, then copy pairs of data columns into the Spreadsheet Template for Statistical Analysis (provided on the Psych Labs Project website), using these three spreadsheet tabs:

1. Search Type Stats: *Main Effect of Search Type* – comparing mean RT for Feature Search and Conjunctive Search collapsed across Number of Objects (difference should be significant)

2. Number of Objects Stats: *Main Effect of Number of Objects* – comparing mean RT for 4 objects and 16 objects collapsed across Search Type (difference should be significant)

3. Interaction Stats: *Simple Main Effect of Number of Objects* for Feature Search – comparing mean RT for 4 objects and 16 objects for Feature Search only (no significant difference?)

*Simple Main Effect of Number of Objects* for Conjunctive Search – comparing mean RT for 4 objects and 16 objects for Conjunctive Search only (significant difference?)