

**Psychology of Perception**  
**Psychology 4165, Fall 2015**  
**Laboratory 3 (week 1):**  
**Stroop Word-Color Task**



J. Ridley Stroop (ca. 1936)

## Lab Overview

So far this semester, our lab activities have involved fixing “broken” PsychoPy experiment scripts by adding missing components. You’ve added stimuli components, such as Text, Images, and Random Dot Kinetograms (RDK); you’ve also added the response components Keyboard and Mouse components. These stimuli and response components are the most concrete elements of what the subjects (i.e., you) experience during the experiment. You even have experience with the more abstract elements of experimentation: By inserting Loops into the flow of an experiment and by loading conditions files (\*.XLSX), you have specified the experimental manipulations to the stimuli. On the analytical end of the experiments, you have become proficient in running segments of R scripts, performing basic computations, and last week you even modified short segments of R scripts to complete the Lab 2 group analysis.

The purpose of Lab 3 is to pull these tasks together into a simple experiment where you build the entire PsychoPy script, collect data, then perform individual and group analyses by assembling the basic data analysis elements R (import, re-organize, analyze, plot). Some parts of the experiment are, by necessity, highly specified (e.g., some components need exact names). Other parts of the experiment don’t need to be so exact, so you have some freedom to customize your experiment.

Lab 3 will recreate a classic experiment from cognitive psychology to observe the Stroop Effect. We will complete Lab 3 over the course of 3 weeks:

**Week 1:** Define the Stroop Effect, build a script in PsychoPy to test it.

**Week 2:** Collect data, build a script in R to analyze individual data, analyze individual data.

**Week 3:** Build a script to analyze group data, analyze group data.

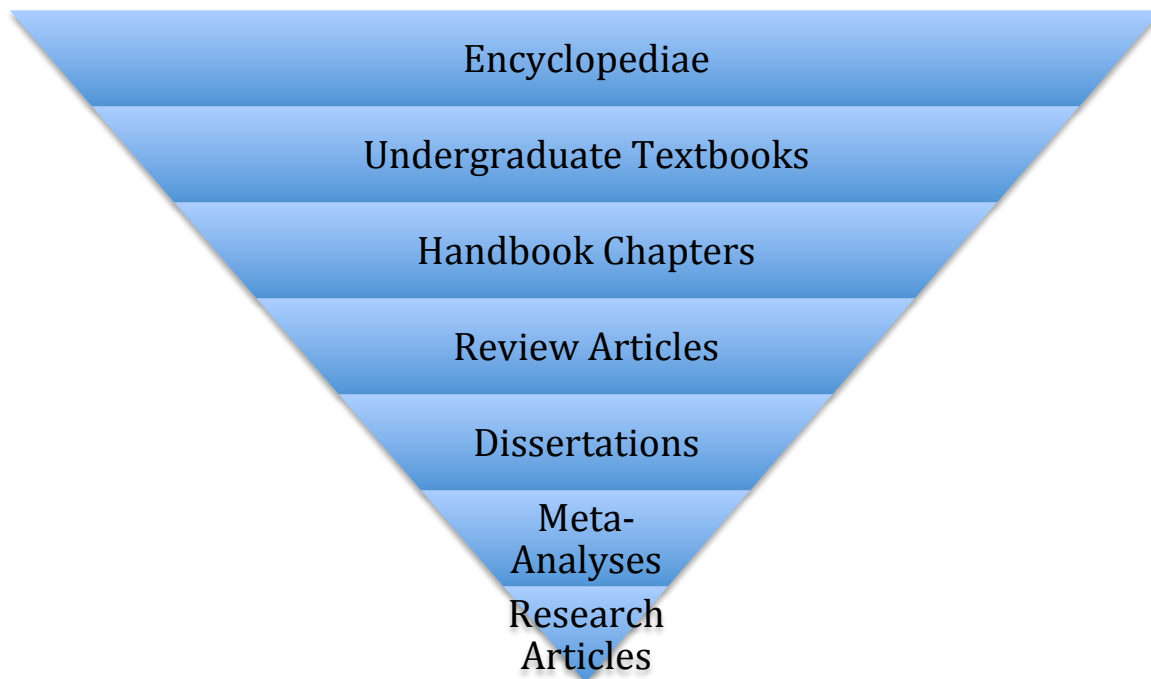
**By the end of this lab, you should be able to:**

- **Build a PsychoPy experiment from scratch**
- **Assemble R script components to analyze individual and group data**
- **Test a hypothesis from response times**

## LAB INSTRUCTIONS

### Introduction Section

We'll begin by performing a brief literature search to define the Stroop Effect, such as what stimuli are traditionally used, and how it's measured. We will also compare/contrast a couple of the major online databases (Google Scholar & Web of Knowledge), each of which have strengths and weaknesses, depending on the purpose of your search. Very often, those new to research have inefficient search strategies, such starting with individual research articles, which provide minimal research context. In Figure 1, I recommended a search strategy that organizes different type of sources by scope (general to specific):



#### Encyclopaediae

1.1	In a web browser of your choice, find the Wikipedia entry on the <u>Stroop Effect</u>
1.2	Copy-paste the Wikipedia description of the Stroop Effect:

#### Review Articles

<p><b>1.3</b></p>	<p><b>In a web browser of your choice, goto Google Scholar (<a href="https://scholar.google.com">https://scholar.google.com</a>)</b></p> <ol style="list-style-type: none"> <li>1. Search for: “Stroop Effect”</li> <li>2. The top hit should be:</li> </ol> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <p>Half a century of research on the <b>Stroop effect</b>: an integrative review. <span style="float: right;">[PDF] from tugraz.at Find it @ CU</span>  <small>CM MacLeod - Psychological bulletin, 1991 - doi.apa.org</small>              Abstract 1. The literature on interference in the <b>Stroop</b> Color and Word Test, covering over 50 yrs and some 400 studies, is organized and reviewed. In so doing, a set of 18 reliable empirical findings is isolated that must be captured by any successful theory of the <b>Stroop</b> ...  <small>Cited by 3851 Related articles All 36 versions Web of Science: 2362 Cite Save More</small></p> </div>
<p><b>1.4</b></p>	<p><b>Download a PDF of the MacLeod (1991) article.</b></p>
<p><b>1.5</b></p>	<p><b>Read the first few paragraphs, STOP when you get to the Heading: “Stroop’s Classic Article” (~midway down the left column on page 164).</b></p> <ol style="list-style-type: none"> <li>1. What was the phenomenon that was so interesting to these authors?</li> <li>2. What was the empirical controversy?</li> <li>3. What was Stroop’s contribution?</li> </ol>

**Research Articles**

<p><b>1.6</b></p>	<p><b>In a web browser of your choice, goto Web of Knowledge (<a href="http://webofknowledge.com">webofknowledge.com</a>).</b></p> <ol style="list-style-type: none"> <li>1. Using the search fields, search for Stroop’s 1935 article, entitled <i>Studies of interference in serial verbal reactions</i>.</li> </ol> <p><b>For example: Author, Year Published</b></p> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <p>Basic Search <span style="float: right;">▼</span></p> <p>stroop <span style="float: right;">✕</span> <span style="float: right;">Author ▼</span></p> <p style="text-align: right; font-size: small;">↳ Select from Index</p> <p>AND ▼ 1935 <span style="float: right;">✕</span> <span style="float: right;">Year Published ▼</span> <span style="float: right; background-color: #0056b3; color: white; padding: 2px 5px;">Search</span></p> <p style="text-align: center; font-size: x-small;">+ Add Another Field   Reset Form</p> </div>
<p><b>1.7</b></p>	<p><b>Download a PDF of the Stroop (1935/1992) research article (it’s an APA reprint).</b></p>
<p><b>1.8</b></p>	<p><b>In 1935, J. Ridley Stroop didn’t have computers to perform his experiments. In your own words, describe the methods in experiment 1</b></p>
<p><b>1.9</b></p>	<p><b>What was the result? Shown in Table I, and in prose on page 17.</b></p>

## Method Section

Time to make our own experiment!

<b>2.1</b>	<b>In a classic Stroop Color-Word Task, what are the independent variables?</b> Independent Variable 1:  Independent Variable 2:
<b>2.2</b>	<b>In a classic Stroop Color-Word Task, what is the dependent variable?</b>

We'll be making a variation of the classic experiment that includes the above variables, and measures response time (RT) one word at a time. Let's begin by defining the experimental conditions in the conditions file, appropriately named `conditions.xlsx`.

<b>2.3</b>	<b>Open</b> <i>Lab 3 Tools &gt; Stroop exp &gt; conditions &gt; conditions.xlsx</i> 1. Note the header names - <b>DO NOT CHANGE THESE</b> . We need these names later in the PsychoPy script.  text                  letterColor          corrAns                  congruent								
<b>2.4</b>	<b>The text column defines the text that our stimuli will be.</b> 1. In this experiment, we'll use the words <u>red, green, and blue</u> .								
<b>2.5</b>	<b>The letterColor column defines the color that our stimuli will be.</b> 1. Also, the colors <u>red, green, and blue</u> . 2. What will a subject see for row 2? Row 10?								
<b>2.6</b>	<b>Subjects will respond by pressing the left, down, and right arrow keys on the keyboard. Here are the instructions (and correct responses):</b>  <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">letterColor</th> <th style="text-align: left;">Correct Response (corrAns)</th> </tr> </thead> <tbody> <tr> <td style="color: red;">red</td> <td>left</td> </tr> <tr> <td style="color: green;">green</td> <td>down</td> </tr> <tr> <td style="color: blue;">blue</td> <td>right</td> </tr> </tbody> </table>	letterColor	Correct Response (corrAns)	red	left	green	down	blue	right
letterColor	Correct Response (corrAns)								
red	left								
green	down								
blue	right								
<b>2.7</b>	<b>The corrAns and congruent columns are blank. Let's fix that.</b>								
<b>2.8</b>	<b>In the corrAns column, add the correct response for each row of letterColor condition (as shown in Box 2.6).</b> 1. Only left, down, or right								

	2. All lower case, no extra characters
<b>2.9</b>	<p><b>In the congruent column, add whether the condition is congruent or incongruent.</b></p> <ol style="list-style-type: none"> <li>1. If the word AND the letterColor are the same, then it is a <u>congruent</u> trial.</li> <li>2. If the word AND the letterColor are NOT the same, then it is an <u>incongruent</u> trial.</li> </ol>
<b>2.10</b>	<p><b>SAVE your changes.</b></p> <p><b>IMPORTANT: Check and recheck that your conditions.xlsx entries are accurate before continuing!!!!</b></p>

**Trial Routine** (must be EXACT)

<b>2.11</b>	<b>Open PsychoPy, and create a new experiment:</b> <i>File &gt; New (⌘N)</i>
<b>2.12</b>	<b>Save the experiment to</b> <i>Lab 3 Tools &gt; Stroop exp</i> <b>as something like:</b> <i>Lab 3 Stroop.psyexp</i>
<b>2.13</b>	<p><b>In the trial routine, add 2 components:</b></p> <ol style="list-style-type: none"> <li>1. A Text component named word.</li> <li>2. A Keyboard component named resp.</li> <li>3. Save &amp; Test.</li> </ol>
<b>2.14</b>	<p><b>In the word component:</b></p> <ol style="list-style-type: none"> <li>1. We want the word to show up half a second after the start of the Routine, and not disappear.</li> <li>2. We want the text twice as big.</li> <li>3. Save, test.</li> </ol>
<b>2.15</b>	<p><b>In the word component:</b></p> <ol style="list-style-type: none"> <li>1. Change the text to say something else (classroom appropriate)</li> <li>2. Change the color of the text (try different color names)</li> <li>3. Try out different combinations of settings</li> <li>4. Save, test</li> </ol>
<b>2.16</b>	<p><b>Add a Loop around the trial routine, and name it trials</b> (probably the default)</p> <ol style="list-style-type: none"> <li>1. In the Conditions field, use the Browse button to load the <i>conditions.xlsx</i> file we fixed earlier.</li> <li>2. If this worked properly, it should read:</li> </ol>

	<p style="text-align: center;"><b>12 conditions, with 4 parameters</b> <b>[text, congruent, corrAns, letterColor]</b></p> <p>3. Save.</p>
<b>2.17</b>	<p><b>Next, add the variables that tell PsychoPy what text to display (\$text), and what color to display that text (\$letterColor). In the word component</b></p> <ol style="list-style-type: none"><li><b>Add the following variables:</b><ol style="list-style-type: none"><li>\$text</li><li>\$letterColor</li></ol></li><li>HINT: Where is the <u>most logical</u> place for these variable names?</li><li><b>IMPORTANT: To the right of the fields you added the variables (\$), change the dropdown boxes to “set every repeat”. If your script doesn’t work properly or crashes during test, this is the most likely culprit!</b></li><li>Save, test.</li></ol> <p>PROTIP: Once it becomes obvious to you that a change you made is working properly (or not), you can end the test with the “Escape” key.</p>
<b>2.18</b>	<p><b>Time to adjust the settings for the Keyboard components you named resp:</b></p> <ol style="list-style-type: none"><li>We don’t want subjects to respond before they see the text stimuli.</li><li>We want to limit subjects responses to the appropriate arrow keys (left, down, up)</li><li>We want PsychoPy to store whether a response was correct or not, (HINT: so we need to tell PsychoPy what the correct answers are)</li><li>Save, test.</li></ol>
<b>2.19</b>	<p><b>At this point, you should probably check to see if PsychoPy is properly storing responses.</b></p> <ol style="list-style-type: none"><li>Open the most recent CSV file in the “data” folder (Remember, the file name has a timestamp).</li><li>In the resp.corr column (1=correct, 0=incorrect)</li></ol>

**Practice Routine** (must be EXACT)

<b>2.20</b>	<p><b>Once you are certain that the trial routine is working properly, we need to add a practice routine before the trial routine so subjects can get used to using the arrow keys to respond.</b></p> <ol style="list-style-type: none"><li>Name the routine “p_trials”, and its Loop “practice”</li><li>The practice routine is <u>identical</u> to the trial routine, except that<ol style="list-style-type: none"><li>The text and keyboard components should different names (e.g., word2, resp2)</li><li>The number of blocks=1 (nReps in the Loop settings).</li></ol></li></ol>
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3. Save, test.

**So far we've created the core of our experiment, now we need to add routines that include on-screen instructions for subjects when taking the experiment.**

Each of these Routines need only 2 components: a text and a keyboard component. The text will show a message to the subject, and the keyboard component will advance the experiment by ending the routine. The names of these routines & components do not really matter, but give the routines names that are meaningful to you. The default component names work just fine.

**Instructions** (can be flexible)

<b>2.21</b>	<b>Add 3 of these instructions/message routines to the experiment</b> <ol style="list-style-type: none"><li>1. Add a routine before the practice routine that welcomes the subject and tells them the task instructions.</li><li>2. Add a routine after the practice routine and the trial routine that tells the subject that the real experiment is about to begin.</li><li>3. Add a routine after the trial routine that thanks the subject for taking your experiment.<ol style="list-style-type: none"><li>a. <i>Alternately</i>, for this final routine, you could omit the keyboard component and set a duration for the text component, (e.g., 4.0s) which would automatically end the experiment after a few seconds.</li></ol></li><li>4. Save, test.</li></ol>
<b>2.22</b>	<b>Change the settings of your text components until they look the way you want.</b>

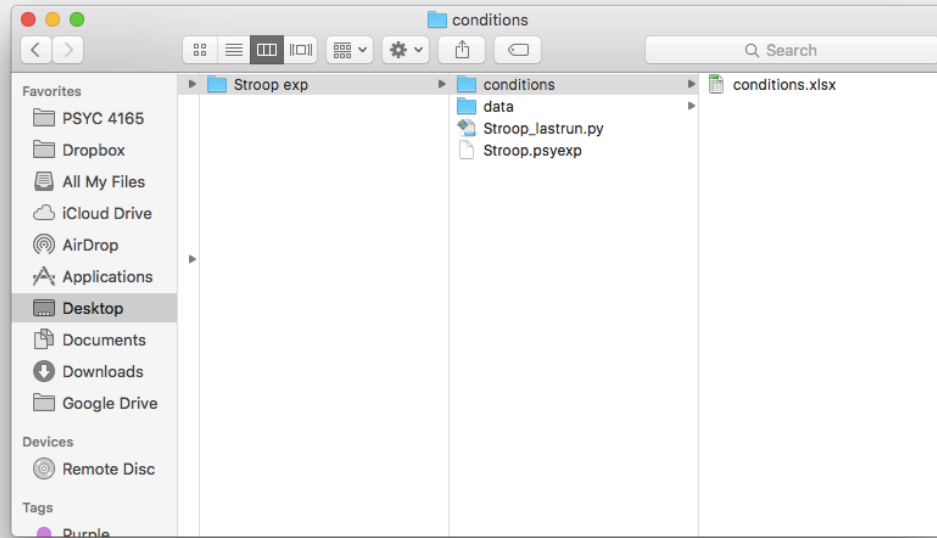
**ZIP & Save your work**

<b>2.23</b>	<b>Once your experiment works properly and looks professional, now is the time to SAVE the experiment for next week<sup>1</sup>.</b> <ol style="list-style-type: none"><li>1. In the data folder, delete all the files that were generated each time you tested your script (i.e., empty the data folder).</li><li>2. Your experiment folder should look something like this:</li></ol>
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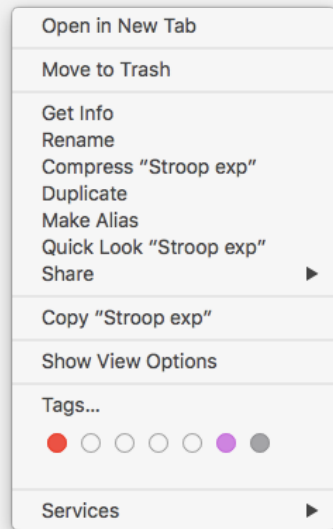
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<sup>1</sup> This will become a crucial procedure in Lab 4 to keep your experiment files organized and working properly!!!!1!!!





3. Compress the experiment folder to make a ZIP file that is easier to save.
  - a. Right-click the folder you want to compress, and select Compress "XXXXX"



4. Save this ZIP file using whatever method works best for you (Flashdrive, GoogleDrive, Dropbox, etc.)