**Instructions**

Although the program is less of a memory hog, it is still good practice to close all the other programs you are running on the computer before starting it. Stimulus timing problems might still ensue.

**Setting parameters**

There are two sets of parameters that need to be set in order to run the experiment. The first set of parameters is set in the file ss\_params.py. These are parameters that are typically changed only once per day of running the program. The following is a description of each of these parameters. Where curly braces appear, the values in the braces are the possible values of the parameter.

* paradigm: {'block'|'rapid\_fire'}: The program can be run in two different modes. In one ('block', the task-design is a block design, meant for use in the scanner. In this case, there are interleaved blocks of the surround suppression task and blocks where no task is performed. In this mode, the fixation color and shape indicates what task should be performed. In the other mode ('rapid\_fire'), the subject is simply asked to continuously perform the task, with short ITI.
* monitor: {‘NEC2’ | 'testMonitor'}: This is the name of a monitor with a psychopy .calib file in the calibration folder.
* screen {0 | 1 [|](https://github.com/arokem/surround_suppression#id1)...}: The number of the screen on which to display the stimuli. 0 indicates the main screen of the computer. 1 indicates an attached auxillary monitor.
* fullscreen {True | False}: Whether or not to show the stimulus in fullscreen mode.
* scanner {True | False}: Whether or not to wait for a ttl pulse to trigger the beginning of stimulus presentation
* start\_target\_contrastA {0-1}: The contrast to start the staircase with for the annulus target. Should be greater than 0.2 (annulus contrast) and be around 0.35 (estimated threshold level)
* start\_target\_orthog\_contrastA {0-1}: The contrast to start the staircase w ith for the annulus target, orthogonal condition. Should be greater than 0.2 (annulus contrast) and be around 0.35 (estimated threshold level)
* start\_target\_contrastB {0-1}: The contrast to start the staircase with for the annulus target without the annulus. Can be in any range, with a minim um of 0.001
* fix\_target\_start {0-1}: Ditto for the fixation target, minimum 0 (contrast of fixation background), max of 1.0, must be highter than fix\_baseline
* ***targetA\_contrast\_max {0.75-1}: Maximum target contrast when annulus is*** present
* targetA\_contrast\_min {0.75}: Minimum target contrast when annulus is present. Better be set to 0.2 (Annulus contrast)
* targetB\_contrast\_max {1}: Maximum target contrast when annulus is not present (not crucial, it is unlikely that subjects will need a very high contrast as compared to no contrast)
* targetB\_contrast\_min {0.001}: Minimum target contrast when annulus is not present (if ceiling performance is an issue, this can be lowered, but pretty close to 0) (Annulus contrast)
* fix\_target\_max {1}: Maximum fixation target contrast
* fix\_target\_min {0.5}: Minimum fixation target contrast - must be at least 0.5 for contrast increment
* trials\_per\_block = 5,
* display\_units {'deg' | 'cm' | 'pix'}: What units to use for stimulus representations. Will determine the units in which the following parameters will be interpreted.
* annulus\_inner {float}: The inner radius of the target annulus
* annulus\_outer {float}: The outer radius of the target annulus
* annulus\_contrast {0-1}: The contrast of the target annulus
* surround\_outer {float}: The outer radius of the outer surround annulus
* surround\_inner {float}: The inner radius of the inner surround annulus
* surround\_contrast {0-1}: The contrast of the surround stimuli.
* ring\_width {float}: The width of the black rings between the stimuli.
* spoke\_width {float}: The width of the black spokes separating the different segments of the target annulus.
* spatial\_freq {float}: The spatial frequency of the gratings
* spatial\_phase{0-2\*pi}: The spatial phase of the gratings (relative to the display).
* temporal\_freq {float}: The temporal frequency (in Hz) of the counter-phase flickering.
* stimulus\_duration {float}: The duration (in sec) of the stimulus.
* response\_duration {float}: The duration (in sec) during which a response can be made
* feedback\_duration {float}: The duration (in sec) between the response\_duration and the start of the next trial (during which feedback is given).
* fixation\_size {float}: The size (in deg) of the fixation stimulus.
* contrast\_increments {int}: The number of contrast increments in the staircase.
* trials\_per\_block {int}: The number of trials in a block in the 'block' mode.
* num\_blocks {int}: The number of blocks to run. The number of trials will be equal to: trials\_per\_block \* num\_blocks.
* dummy\_blocks {int}: In 'rapid\_fire' mode, this is the number of dummy blocks at the very beginning of the run.

At the beginning of a day of experimentation, choose the paradigm you want to use and set the monitor to the one you are using. Also set whether that monitor is screen 0 or screen 1 of the computer.

**Running the program**

In order to run the program, open the psychopy application (which should be in the Applications folder). If there is no "File" menu, click "view" and choose "Open Coder View", then choose the "File" menu, navigate to the folder in which the program has been saved and open the file ss\_run.py. Click the green icon of the running man to start running the program. When you do that, a GUI will appear, asking you for details of this run. Enter the subject ID, the surround and annulus orientation. Choose the task to be performed. Also choose the condition with surround or not. The replay button allows you to read a previous runs contrast values for the task not performed in this run and will replay these contrast values. If replay is not set, the other task contrast values will be set to the parameter setting the start of the staircase for that other task. Press 'Done'.

The experiment begins with a text prompting subject to press any key to start. When the key is pressed, if the scanner parameter is set to 'True', the program waits for a ttl pulse to start running. Otherwise, that block will simply start. A fixation appears and after that, the first trial starts. Each trial is composed of the following events: A stimulus is presented for some duration. After the stimulus is presented, the program waits for a response from the subject (but this wait is terminated after a certain amount of time). Auditory feedback is played and the staircase is updated. Then the program goes to the next trial.

**Subject task**

There are two tasks, the annulus task and the fixation task. In each of the tasks, blocks alternate depending upon whether the annulus is present or absent. In addition, at fixation there is a grey square surrounding the green or red fixation square. One corner (upper left,upper right, lower right, or lower left) of the grey square will have greater luminance.

In the annulus task, subjects have to always respond in which corner one of the segments contains a contrast increment. In one block (annulus on), this will appear as a segment with "clearer stripes". In the other block (When the annulus is off), this appears as a single, low-contrast grating. The fixation task will appear, but is task irrelevant.

In the fixation task, subjects will be asked to determine in which corner (upper left,upper right, lower right, or lower left) a luminance increment at fixation occurs ("which side appears brighter?"). The task is the same for both block A and block B. The annulus will be present in block A but not block B, but the presence/absence of the annulus will be task irrelevant.

**Analyze Runs**

Analyzing runs is also done directly through the PsychoPy application. Open analyze\_run.py in a Coder view. When clicking the "run" button, a gui will appear in which you can select the file (default location is the data directory, into which the data files get saved per default). This script will take some time to run. When it is complete the output (on the lower part of the Coder view) will appear as:

Surround: horizontal (orientation)

Annulus: horizontal

Surround contrast: 0.8 (0 means no surround, none 0 means there is surround)

Threshold estimate: 0.146638707765, CI: [0.136072124443,0.157652909944]

where task is the task run during the session (Annulus or Fixation), annulus\_off/on is the block, threshold estimate is the estimate of that block(mean of bootstrapping) and CI is the 95% confidence interval of the threshold, calculated using a bootstrapping procedure. In addition, this script will produce a figure, one for each block type. You can open them in the terminal by typing open Name\_of\_file.png (for instance Name of file = SS\_subjectname\_date\_filenumber.png) or just double-clicking on the files in the Finder application.

**Monitor calibration**

Calibration of new monitors is done using the file new\_monitor.py. Edit the file by adding the details needed (see the already existing monitors). Then run the script by entering 'python new\_monitor.py' in a terminal. This should create a new psychopy .calib file in the calibration directory, which you can now use in subsequent runs of the experiment

**Program structure**

ss\_classes contains the main classes used in the program:

* Params: This object initializes params from a given file, which contains a dict with variables. For every variable in the dict, an attribute of the Params object will be created. Notice that attributes of a params, once they are set, cannot be changed, unless their name is explicitely removed from a special attribute, which is a list called '\_dont\_touch'. The 'set\_by\_gui' method of this object opens a gui made by the tool "GetFromGui". The 'save' method saves the parameters into an already opened file (and can optionally close that file).
* Event: This is an abstract base-class outlining the kinds of things that an event in the experiment could have: - \_\_init\_\_ initializes the object with a window object and with key-word

args.

* + finalize : this allows to change parameters of an already initialized object
  + \_\_call\_\_ : this usually triggers '.draw()' methods in attributes of the object that have '.draw' methods (psychopy stimuli) and calls '.flip()' on the window object held by the object
* Staircase: This object represents a psychophysical staircase. Initializing it generates an attribute record, which is a list with, at initialization, only the start value of the staircase. The 'update' method updates the staircase, based on a correctness value.
* Stimulus: This class represents and holds all of the stimulus. This includes the surround and the annulus gratings, as well as the fixation and the spokes and rings. Upon initialization, all of this gets allocated in memory. Finalization of the stimulus adds the target to the setting additional stuff in the stimulus, such as
* Trial: This monster holds all the information needed for a trial.