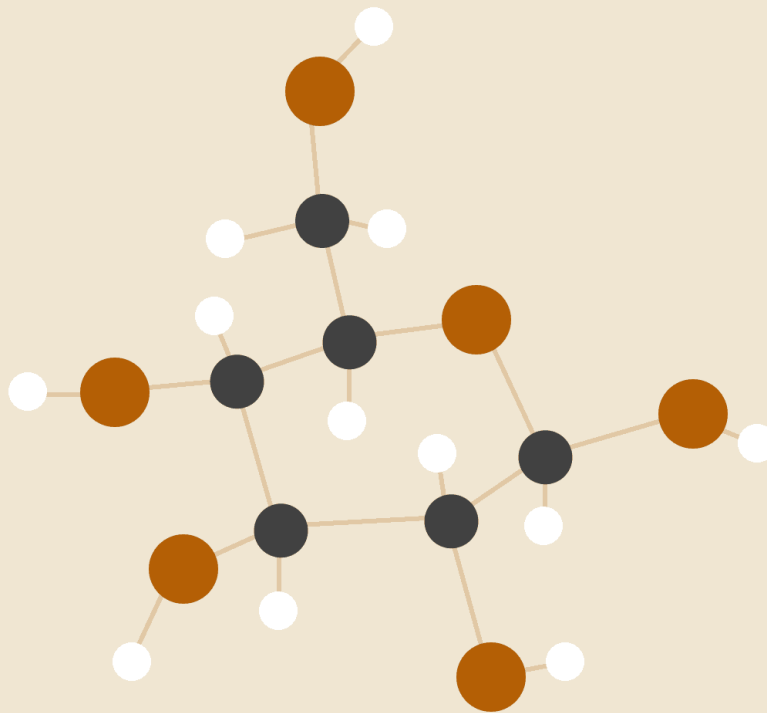


HW2 - Neuroscience Lab

Assignment2 - Psychtoolbox3 Behavioral Task



Mohamad Hosein Faramarzi

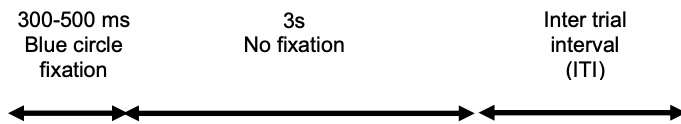
Apr 20 2024

Sharif University of Technology

EE Department

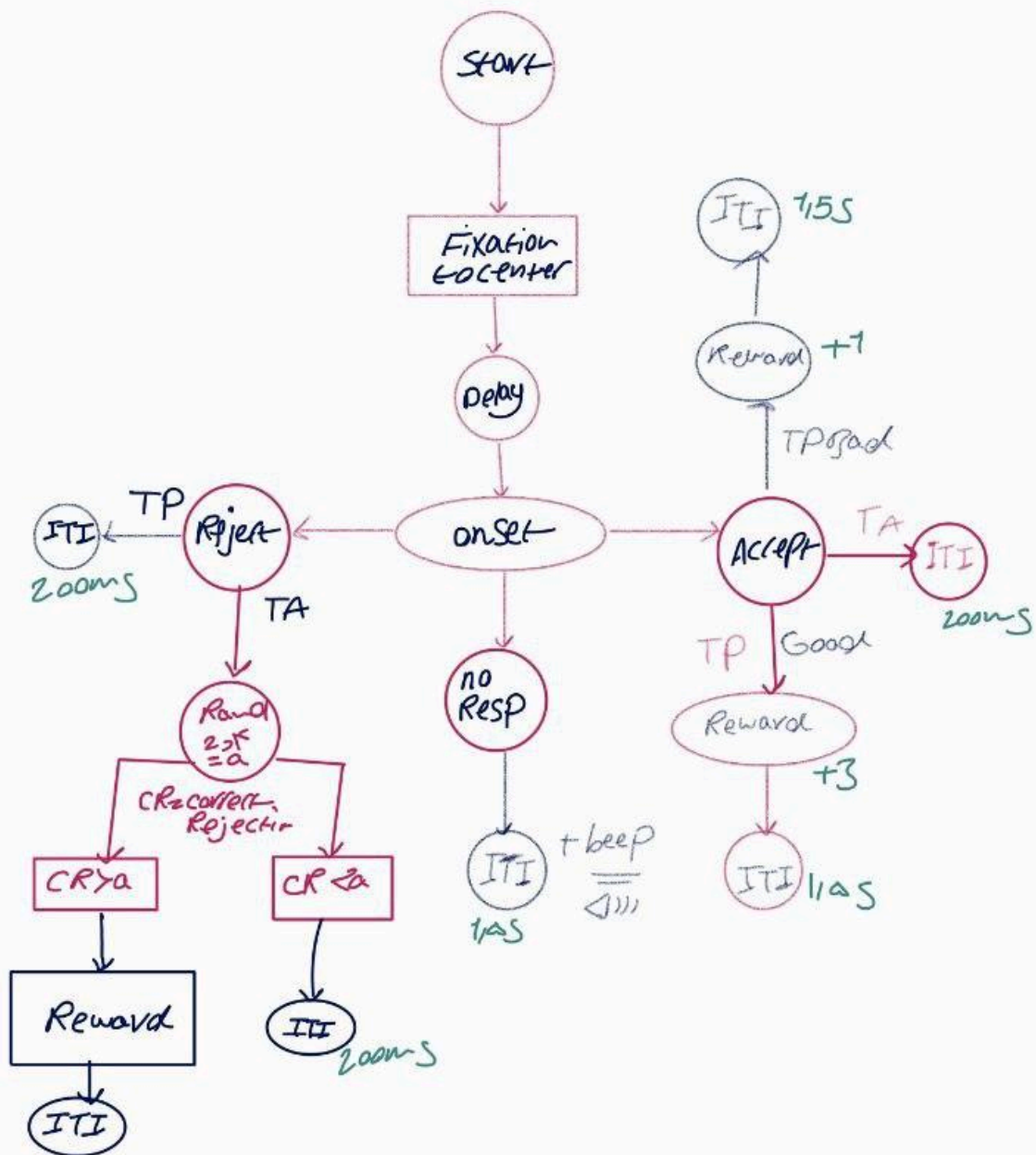
Here is the description of each trial :

Each Trial:



- 1. No press: error beep, 1.5s ITI
- 2. Reject press (TA): low reward delivery after each 2-4 random correct rejection
 - ITI for reward delivery: 1.5s
 - ITI for no reward delivery: 200ms
- 3. Reject press (TP): same as above(2) without reward
- 4. Accept press:
 - No fractal selection: error beep, 1.5s ITI
 - Fractal selection: associated reward delivery, 1.5s ITI

Based on this process of each trial we can draw this state diagram:



2. We want to use different combinations of fractals for each subject in a way that each fractal appears equally in each of the 4 aforementioned categories (Value/Perceptual, Good/Bad) in order to control the bias of low-level guiding features and recognition difficulties among fractal objects. Implement random assignment as described above. How many subjects do we need for equal appearance?

We totally have 48 fractals and this fractals are in 4 categories :

Value Stimuli / Perceptual Stimuli / Good Stimuli / Bad Stimuli

There are 48 total fractals.

Each session has 144 trials (as mentioned previously, $48 \text{ fractals} * (TP + TA) / 2$).

Total Trials per Subject = Sessions * Trials/Session = 4 sessions * 144 trials/session = 576 trials

576 is a multiple of 4 ($576 = 4 \times 144$). Therefore, if we have 48 subjects, each participating in 4 sessions with 144 trials per session, each fractal will be presented a total of 12 times (576 trials / 48 subjects).

This allows for random assignment within each session while ensuring each fractal appears equally in all four categories across all subjects:

Value (Good): 3 times (out of 12)

Value (Bad): 3 times (out of 12)

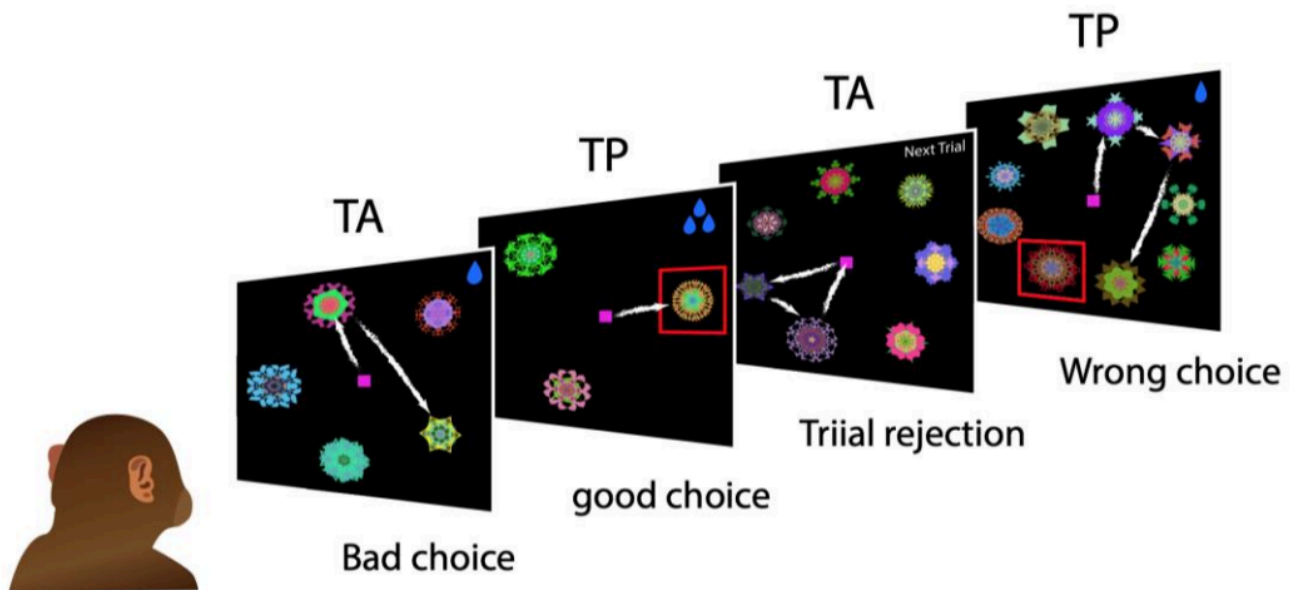
Perceptual (Good): 3 times (out of 12)

Perceptual (Bad): 3 times (out of 12)

With less than 48 subjects, it wouldn't be possible to guarantee equal appearance across all categories for all fractals using random assignment within sessions.

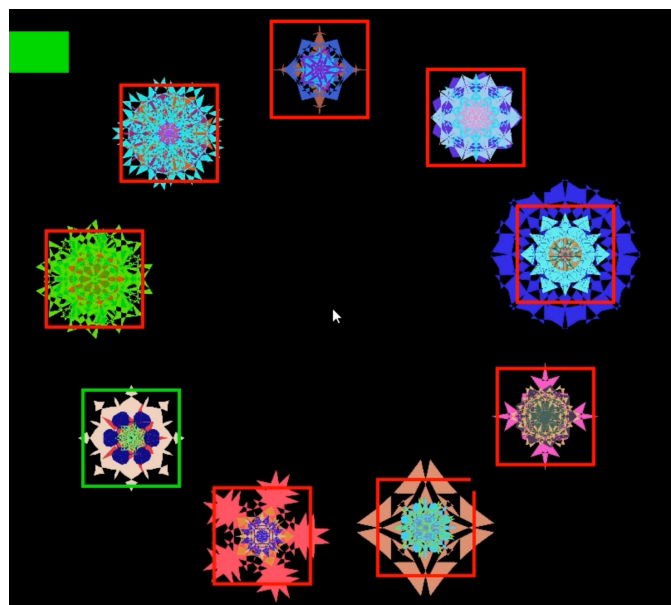
4. Implement Search Phase as described in Experiment structure. In the beginning of script we should collect subject ID and session number. Use mouse position to simulate eyes movement. Use keyboard for key pressing (Accept: Space, Reject: X). Draw green and red rectangle for good and bad fractals as shown in Assignment2.mov. Prepare Recorded video of your final search task in the same way as Assignment2.mov. Recorded video should include occurrence

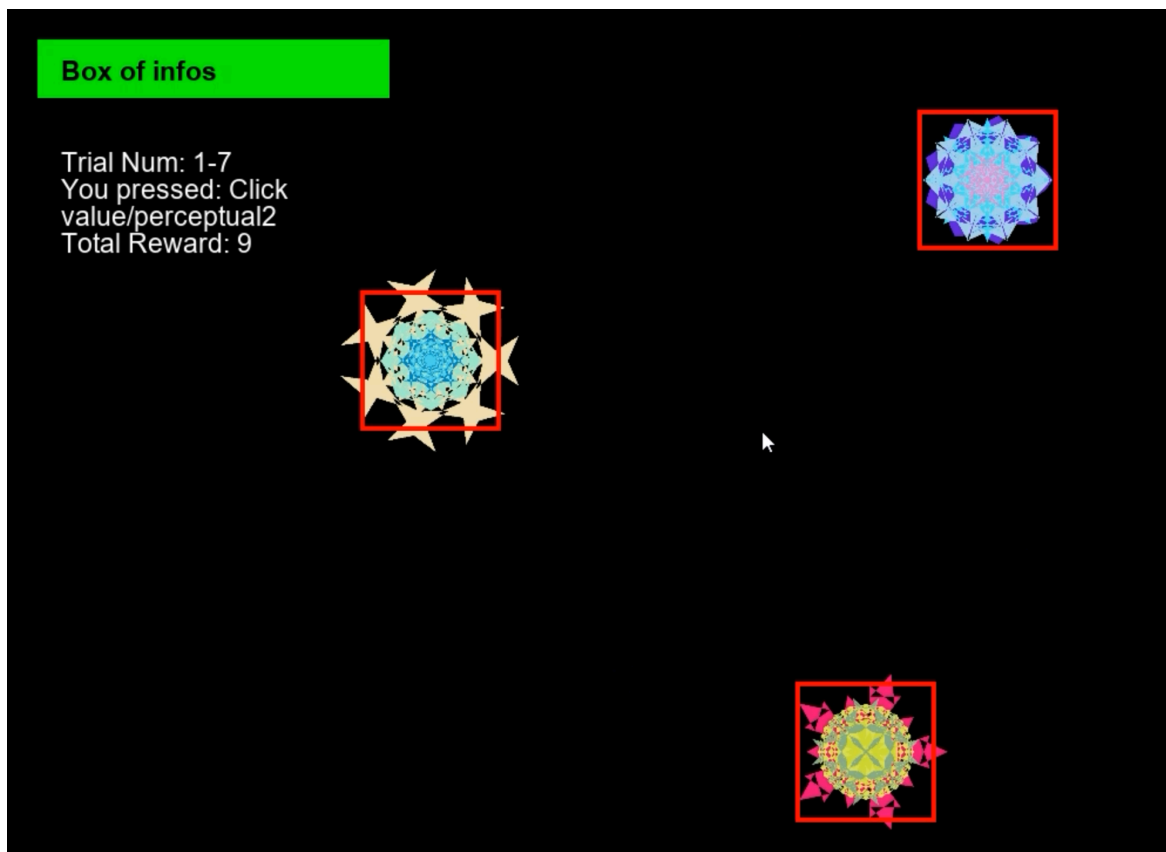
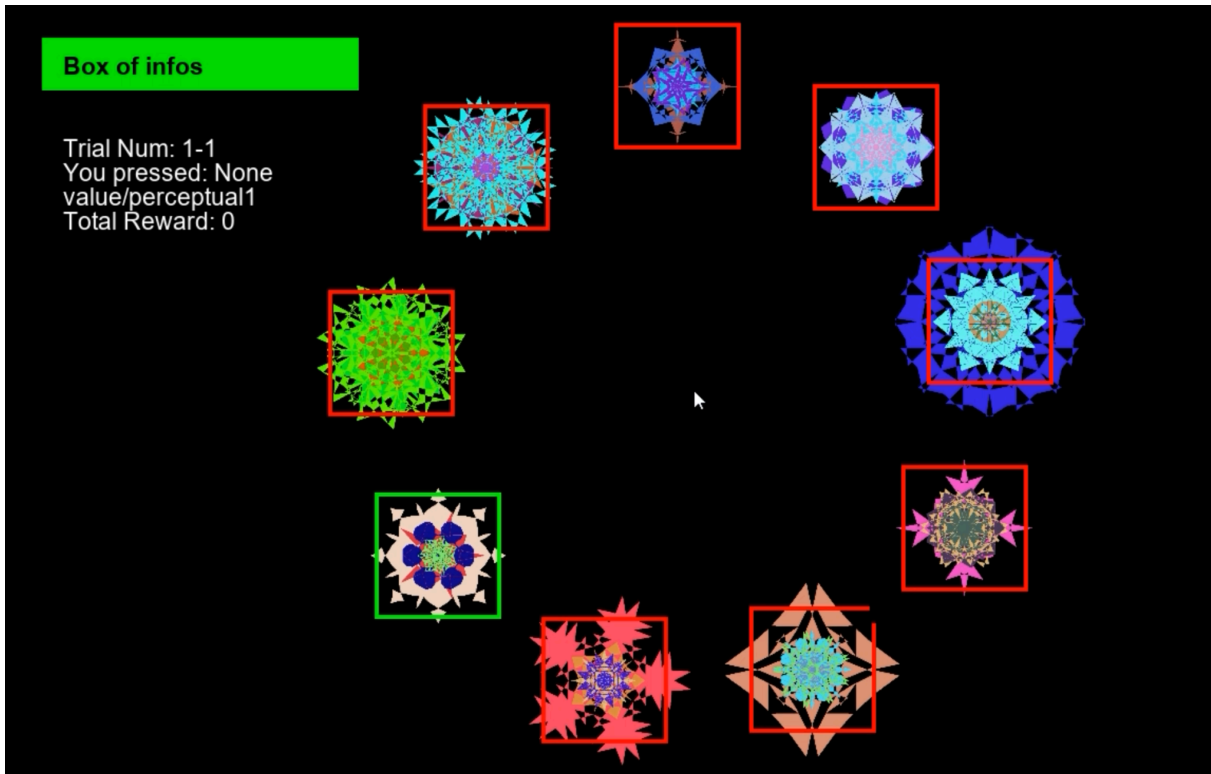
Here is the structure of Task:



Based on this Structure we implemented the task with a few small changes. We have recorded the search task in a 2 minute video named Assignment2_99104095.mov .

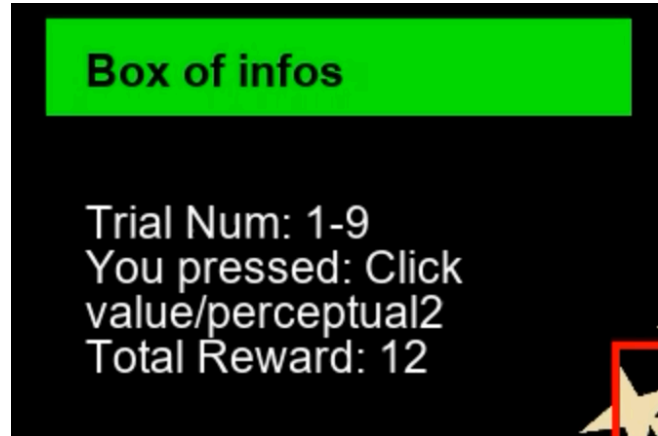
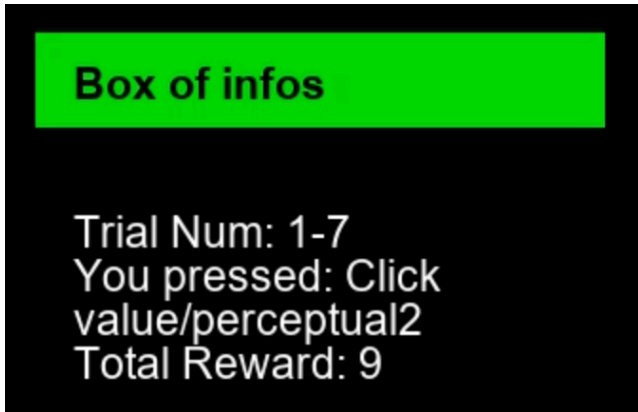
Also in the bellow we have shown some part of the search task pictures as a few samples.





5. Draw information box in some corner of recorded video for each trial. information box should contain key pressed, value/perceptual group and reward amount.

Here is the picture of information box of the task:



We used this function code to implement the information box and we call the function in every trials to show information box:

```
function informationBox(session_num, trial_num, key_pressed, total_reward, wPtr, rect)
    rect_box = [rect(3)-1300, 50, rect(3)-1000, 260];
    Screen('TextSize', wPtr, 23);
    myText = cat(2, '\n', 'Trial Num: ', num2str(session_num), '-', num2str(trial_num),

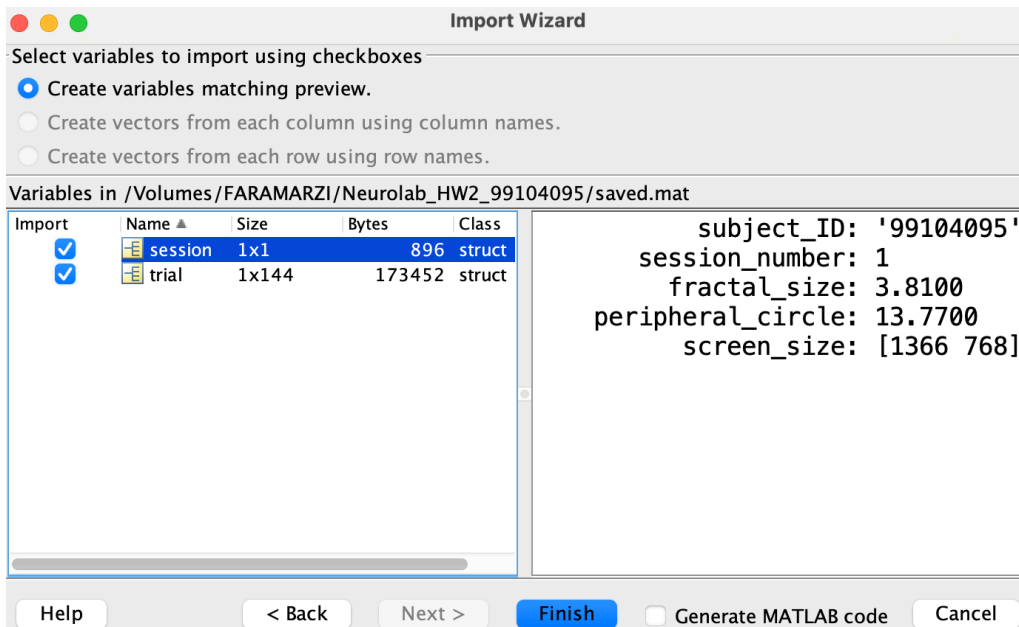
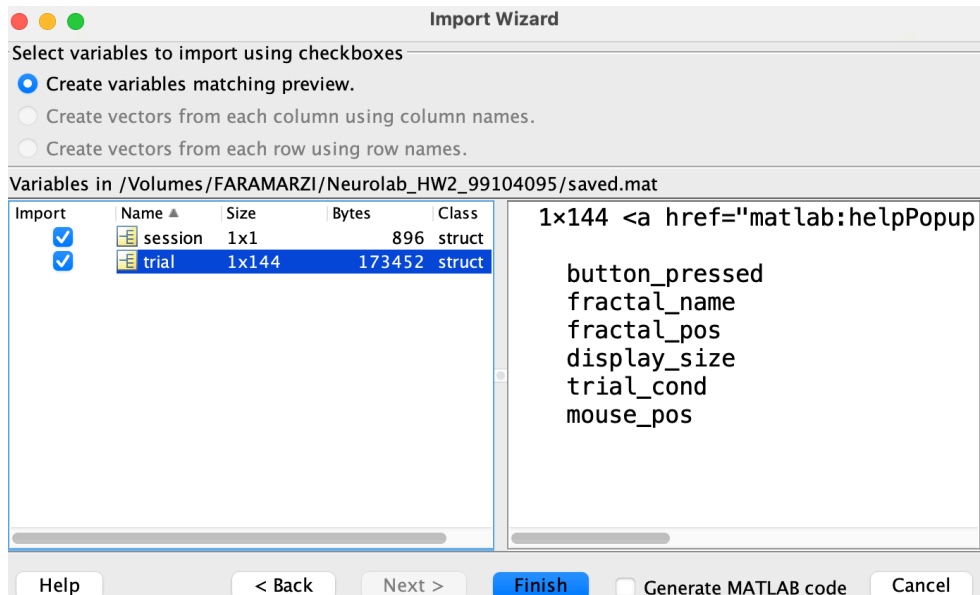
    % fill
    Screen('FillRect', wPtr, [0 255 0], [rect_box(1), rect_box(2), rect_box(3), rect_
    Screen('TextStyle', wPtr, 1);
    DrawFormattedText(wPtr, 'Box of infos', rect_box(1)+20, rect_box(2)+35, [0 0 0]);

    % box
    Screen('TextStyle', wPtr, 0);
    DrawFormattedText(wPtr, myText, rect_box(1)+20, rect_box(2)+90, [255 255 255]);

end
```

6. Proper output data at the end of script as will describe below. Save it to a single .mat file.
 - Subject ID, session number, fractal size in degree, peripheral circle degree, screen size
 - At each trial: button pressed, fractals name, fractals position on display, DS, value/perceptual group, TA/TP, mouse position in time.

We have saved the saved .mat data as output.mat.



7. Explain the reason for selection different ITI in TA and TP? Looking at below paper would be helpful.

Ghazizadeh, A., Griggs, W., & Hikosaka, O. (2016). Object-finding skill created by repeated reward experience. *Journal of Vision*, 16(10):17, 1–13, doi:10.1167/16.10.17.

Selecting different intertrial intervals (ITI) for target absent (TA) and target present (TP) trials serves important functional and motivational purposes, as discussed in research like the paper by Ghazizadeh, Griggs, and Hikosaka. Here's why different ITIs are employed:

1-In TP trials, where subjects successfully identify the target, a reward is given. This reward delivery, like juice to a monkey, takes time not only to dispense but also for the subject to consume. Thus, the ITI for TP trials is extended to accommodate this process. This is crucial to ensure the reward maintains its intended motivational impact, encouraging the subject to continue participating attentively.

2-TA trials, where the subject correctly rejects the absence of a target, feature a shorter ITI. This approach is strategically used to keep the subject engaged. The quicker succession of trials following correct rejections minimizes downtime, potentially keeping the subject more alert and responsive. This faster pace can increase the number of trials a subject completes in a session, enhancing exposure to the learning tasks and boosting the efficiency of the learning process.

3-The different lengths of ITI also serve a behavioral conditioning function. By making the ITI shorter for TA trials, the experiment subtly nudges subjects to aim for correct identifications in TP trials. Knowing that correct decisions in TP trials not only result in a reward but also a longer break (due to the extended ITI) might motivate subjects to focus more and make accurate judgments. On the other hand, the shorter ITI in TA trials quickly redirects the subject's attention back to the task, maintaining a rhythm that keeps them engaged and less likely to disengage.