1 The experiments

The task that the subjects are being asked to perform is a variation of the Random Dot Motion task, in which the subject is presented with a visual input of a black screen with two red dots a certain distance apart, which represent flowers. Throughout the time of a trial, a yellow dot appears, representing a bee, which changes position. The subjects are explained that the bee is flying around one of the flowers, and they have to decide around which one.

The position of the bee, in the visual input, is in reality being generated as a normally-distributed variable with mean around one of the flowers. A decision by a subject is said to be right if they choose the flower (left or right) which was used to generate the visual input.

The subject makes a decision by moving a joystick to the left or the right, depending on the decision. The subject must maintain the position of the joystick for as long as the trial lasts.

Additionally, the flower around which the bee flies is changed in the middle of the trial, to measure how quickly the subjects notice it. When the subject notices it, a second movement, now to the other side, is initiated. This is called a re-decision.

The file GetData contains a function which generates the joystick movements for simulated subjects performing this task. To see how the function works, use the help file or read the code.

2 The exercise

We will be using the simulated data to calculate average reaction times. For each subject and each trial, we will calculate the time it took them to make the first decision (DT), and the time it took them to realize that there was a change of flower, called re-decision reaction time (RDRT).

First, we will calculate these numbers for a single subject, using a single trial. Then, we will make calculations with a single subject, many trials. Finally, with all subjects, all trials.

To calculate for a single subject, single trial, follow the next steps:

1. Create data with the GetData function. See the help file of this function (or read the code) to see what it does and what its outputs and inputs are. Save the outputs of the function to a set of variables. For the following steps, we will assume that these variables are called, as in the GetData function, "'js"' and "'inp"', though you can name them what you want.

2. Take the first trial of the first subject from js and inp and save them to another variable (e.g. "'js1"' and "'inp1"').

3. From the data, find the number of subjects, trials and time points. Do not set these values manually; rather, use the function `size` to obtain the info directly from the data. Name them: T for the number of time points (milliseconds), nS for the number of subjects and nT for the number of trials.

4. Plot this data using the plot command. Use the following code:
   `figure, plot(1:T, inp1, 1:T, js1)`

5. From the data in inp1, find the time t_{ic} at which the input changes from the flower on the left (0) to the flower on the right (1). Use the `find` function for this.

6. Find the decision time t_{dt}, defined as the time in which the joystick moves from 0 to -1 (in these data). Because the joystick movements are noisy, it might be that it never actually reaches -1. Because of this, we will use a threshold: we will consider a decision made if the joystick gets within a distance from -1. Call this distance `thres = 0.3`. We will move this value later.

7. Find the re-decision time t_{rdt}, defined as the time in which the joystick goes from -1 to 1. Again, the threshold applies here. With this time, find the re-decision reaction time t_{rdrt}, defined as $t_{rdrt} = t_{rdt} - t_{ic}$.

8. For this subject, find out if the decision time is bigger or smaller than the re-decision reaction time. If it is, display a message (using either `sprintf` or `display`) to the effect of "'For this subject, the re-decision reaction time was greater than the decision time"'. Display the adequate message if the opposite was true.

Now, we will calculate some numbers for a single subject, for all the available trials.

1. Create a function called SingleTrial, which takes as input the data for a single subject, a single trial. Essentially, it is most of the code from the previous part of the exercise, except for the plotting and the generation of the data. The output of this function should be the numbers t_{dt} and t_{rdrt}.

2. Create a script (it can also be a function), called main, in which you create the data using the GetData function. As with the previous exercise, save these data into some variables inp and js.

3. In the script main, create a for loop that runs through all the trials. Inside the loop, the variables js1 and inp1 should be created, which are the data for each trial. Still within the loop, call the function SingleTrial with

inputs js1 and inp1. This will calculate the decision time and re-decision reaction time for the current trial. Save this into components of a vector. These vectors (one for decision time, one for re-decision reaction time) will contain the times for the one subject, throughout all the trials.

4. Use these two vectors to calculate the average decision time and re-decision reaction time for this subject.