# PRELIMINARY NOTES

This source code was used to produce the simulation results in the following paper:
Verduzco-Flores, O'Reilly, "How the credit assignment problems in motor control could be solved after the cerebellum predicts increases in error" Front Comput Neurosci. 2015; 9: 39.

Using this code requires Matlab R2012b or above, along with the Simulink and SimMechanics packages.

The structure of the SimMechanics model is in this figure:
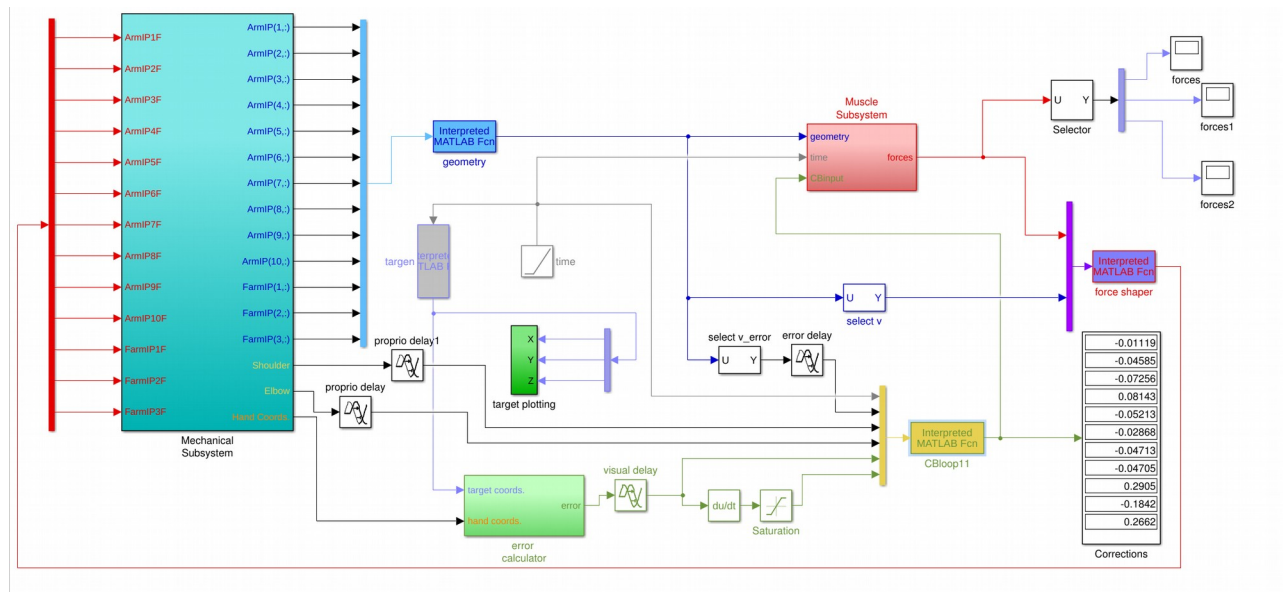
The yellow block, labeled "CBloop11" specifies the Matlab function that will perform the putative cerebellar computations. There are 3 options here: CBloop11c, CBloop11cd, and CBloop11d. The appropriate choice depends on the model being run.

RUNNING ONE REACH AT A TIME

In order to run the simulation of a single reach with the model 1 (section 3.2.1):

1) Open Matlab and set "Arm11" as the working directory.
2) Open "Arm11c.slx" .
3) Open the file "params11c.m" .
4) In "params11c.m", make sure that starting with line 9 we have:

```matlab
% ----- these lines are not needed if calling from reach_runner
first_sim = true;
if first_sim
    clear all;
    first_sim = true;
end
close all;
%first_sim = false;
% -----
```

5) Run "params11.c" .
6) Run "Arm11c.slx" in the Simulink window.

After the simulation is over, more reaches can be simulated using the features learned in the previous reaches. To do this,

7) In "params11c.m", make sure that starting with line 9 we have:

```
% ----- these lines are not needed if calling from reach_runner
% first_sim = true;
% if first_sim
%    clear all;
%    first_sim = true;
% end
% close all;
first_sim = false;
% -----
```

8) Run "params11c.m"
9) Run "Arm11c.slx" in the Simulink window.

In order to run the simulation of a single reach with the model 2 (section 3.2.2), the procedure is the same as above, but we use Arm11d.slx, and params11d.m . Please make sure that the "CBloop11" block in Simulink has the value "CBloop11d". Also, make sure that lines 68 and 69 of the file "CBloop11d.m" are as follows:

```
if (lengths(i) > avgLen(i)) && (Tlengths(i) < lengths(i)-.0) ...
        && (u(1)-TLCS(i) > 0.2) % && (CS > 0)
```

In order to run the simulation of one reach with model 3 (section 3.2.3) we use exactly the same programs used for model 2 above. We only need to change one single line. In the file "CBloop11d.m", uncomment the requirement for increasing distance between hand and target, namely, lines 68 and 69 should look like:

```
if (lengths(i) > avgLen(i)) && (Tlengths(i) < lengths(i)-.0) ...
        && (u(1)-TLCS(i) > 0.2) && (CS > 0)
```

In order to run the simulation of one reach with model 4 (section 3.2.4) we use Arm11d.slx, params11cd.m, and "CBloop11cd" in the "CBloop11" block in Simulink.

RUNNING MULTIPLE REACHES

The script "reach_runner.m" can run multiple successive reaches without the need of using Simulink's GUI.

When using reach_runner, make sure that in the parameter initialization files (params11x.m) the lines 10-16 are commented out.

In line 10 of "reach_runner" you can specify whether to use Arm11c or Arm11d, and in line 25 you can specify which parameter initialization file to use.

* To run model 1, use Arm11c, and params11c.

* To run model 2, the Arm11d.slx model should be saved with "CBloop11d" in the "CBloop11" Simulink block. Also, lines 69 of CBloop11d.m should be as indicated above. In reach runner specify Arm11d, and params11d.

* To run model 3, the Arm11d.slx model should be saved with "CBloop11d" in the "CBloop11" Simulink block. Also, lines 69 of CBloop11d.m should be as indicated above for the case of model 3. In reach runner specify Arm11d, and params11d.

* To run model 4, the Arm11d.slx model should be saved with "CBloop11cd" in the "CBloop11" Simulink block. In reach runner specify Arm11d, and params11cd.

CHANGING THE TARGET COORDINATES

The coordinates of the target are set in lines 17,18,19 of the file targen.m .