**Instructions for Running Bayesian Regression Models**

The following provides information for running each of the Bayesian regression models reported in the accompanying paper. All analysis code is provided to the user “as is” and may be freely manipulated or distributed. **Please cite the original paper if any of the provided data is used in any capacity**. There is no expectation for the author to provide technical guidance or assistance with troubleshooting, running, or adapting any portions of the code.

1. Extract all files in the BayesianModels.zip folder into the ***same directory/folder***. There should be nine files:
   1. Female\_PerfOnly.csv
   2. Female\_PracticeOnly.csv
   3. HDIofMCMC.R
   4. plotPost.R
   5. 2LvlHLMBetaDV.R
   6. 2LvlHLMBinomialDV.R
   7. 2LvlHLMExponentialDV.R
   8. 2LvlHLMNormalDV.R
   9. BayesMediation.R
2. If necessary, download and install R (<https://cran.r-project.org/>)
3. If you have not done so previously, install the runjags package; additionally, the mcmcplots package can be used to visually inspect the trace plots for the MCMC samples. These packages can be installed by typing the following commands into the R console window:

install.packages(“runjags”)

install.packages(“mcmcplots”)

1. Specific instructions to run the analyses for each of the hypotheses presented in the paper are provided below. In general, the analysis to run each Bayesian regression model is broken into four sections designated by the following labels: (1) THE MODEL, (2) THE DATA, (3) RUN THE CHAINS, and (4) EXAMINE THE RESULTS. When running the model, it is recommended that you step through each section individually/line-by-line to understand what is happening. Alternatively, you may select and run the entire script all at once.
   1. Hypothesis 1: Declarative knowledge
      1. Open 2LvlHLMBinomialDV.R
      2. Ensure that line 9 of the R script file reads:

DV = "knowtest"

* + 1. Ensure that line 70 of the R script file reads:

dat <- read.csv("Female\_PerfOnly.csv")

* + 1. Run script
    2. Running lines 143-146 will produce plots of the posterior distributions for each of the Lvl-2 regression coefficients
  1. Hypothesis 3: Metacognitive activity
     1. Open 2LvlHLMNormalDV.R
     2. Ensure that line 9 of the R script file reads:

DV = "Metacog"

* + 1. Ensure that line 70 of the R script file reads:

dat <- read.csv("Female\_PerfOnly.csv")

* + 1. Run script
    2. Running lines 152-155 will produce plots of the posterior distributions for each of the Lvl-2 regression coefficients
  1. Hypothesis 4: Practice trial study manual—processing cues
     1. Open 2LvlHLMBetaDV.R
     2. Ensure that line 9 of the R script file reads:

DV = "prosecute\_manual"

* + 1. Ensure that line 70 of the R script file reads:

dat <- read.csv("Female\_PracticeOnly.csv")

* + 1. Run script
    2. Running lines 153-156 will produce plots of the posterior distributions for each of the Lvl-2 regression coefficients
  1. Hypothesis 4: Practice trial study manual—task strategies
     1. Open 2LvlHLMExponentialDV.R
     2. Ensure that line 9 of the R script file reads:

DV = "strategy\_manual"

* + 1. Ensure that line 74 of the R script file reads:

dat <- read.csv("Female\_PracticeOnly.csv")

* + 1. Run script
    2. Running lines 159-164 will produce plots of the posterior distributions for each of the Lvl-2 regression coefficients
  1. Hypothesis 5: Practice trial contacts engaged
     1. Open 2LvlHLMNormalDV.R
     2. Ensure that line 9 of the R script file reads:

DV = "NumEng\_marker"

* + 1. Ensure that line 70 of the R script file reads:

dat <- read.csv("Female\_PracticeOnly.csv")

* + 1. Run script
    2. Running lines 152-155 will produce plots of the posterior distributions for each of the Lvl-2 regression coefficients
  1. Hypothesis 6: Performance trial score
     1. Open 2LvlHLMNormalDV.R
     2. Ensure that line 9 of the R script file reads:

DV = "TotPts"

* + 1. Ensure that line 70 of the R script file reads:

dat <- read.csv("Female\_PerfOnly.csv")

* + 1. Run script
    2. Running lines 152-155 will produce plots of the posterior distributions for each of the Lvl-2 regression coefficients
  1. Hypothesis 6: Performance trial contacts engaged
     1. Open 2LvlHLMNormalDV.R
     2. Ensure that line 9 of the R script file reads:

DV = "NumEng\_marker"

* + 1. Ensure that line 70 of the R script file reads:

dat <- read.csv("Female\_PerfOnly.csv")

* + 1. Run script
    2. Running lines 152-155 will produce plots of the posterior distributions for each of the Lvl-2 regression coefficients

1. The script to run the Bayesian mediation models is found in BayesMediation.R. The analyses proceed in a two-step process. The first step involves computing the mediator and outcome variables using hierarchical Bayesian regression. The second step is a series of single-level Bayesian regression model used to compute the c-path/total effect (ST 🡪 outcome); a-paths (ST 🡪 mediator); b-paths/indirect effect (mediator 🡪 outcome); and the c’-path/direct effect (ST 🡪 outcome controlling for mediator).
   1. It is recommended when running the mediation analyses to run each regression model one at a time rather than all at once (though you may do so). However, you MUST run all the models to obtain the final mediation results.
   2. The posterior distributions for each path in the mediation provided in Figure 6 of the manuscript are produced by running lines 1278-1306.