Instructions for running the analyses on the model

Accompanying the paper: "Learning from Experience with Delayed Feedback"

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Hazhir Rahmandad
Ph.D. Student, Sloan School of Management, M.I.T
E53-364A, 30 Wadsworth Ave., Cambridge, MA 02142, U.S.A
617-253-3865
hazhir@mit.edu

Nelson Repenning
Associate Professor, Sloan School of Management, M.I.T
E53-335, 30 Wadsworth Ave., Cambridge, MA 02142, U.S.A
617-258-6889
nelson@mit.edu

John Sterman
Professor, Sloan School of Management, M.I.T
E53-351, 30 Wadsworth Ave., Cambridge, MA 02142, U.S.A
617-253-1951
jsterman@mit.edu

You can open the model, "MainModel.mdl", in Vensim. The model has 10 different views, encompassing 932 variables, 270 of which are stocks. You will need the professional version of Vensim in order to replicate the sensitivity analysis on this model, however, the basic structures and behavior can be analyzed using the free personal learning edition (PLE) of Vensim, available at www.vensim.com.

To run the analysis, most of the changes in parameters are done in the "Sensitivity" view. Some of the analyses need other software, namely a spreadsheet and a statistical package, to manipulate the data into desired templates and run different regression analysis over the data. In this manual, we go through a brief description of the steps required to replicate the analyses in the paper.

Base Run Analysis

All model parameters are set for their base case, so you don't need to change any of parameter settings.

- Run a sensitivity analysis, changing "Xpayoff noise seed" as a vector between 1 and 100. The following lines show the required sensitivity control code:

```
100,M,1234
XPayoff Noise Seed=VECTOR(1,100,1)
```

You will need to create a save list to specify the variables to be saved during the simulation. The following save list file can be used for this analysis:

```
Acheived to optimal payoff percentage[Rgr]
Acheived to optimal payoff percentage[Crr]
Acheived to optimal payoff percentage[Myo]
Acheived to optimal payoff percentage[Pfr]
Convergence Time[Rgr]
Convergence Time[Crr]
Convergence Time[Myo]
```

Convergence Time[Pfr]

You will then need to export the results of simulation into an excel file (Model>Export Dataset …) and take the average over the 100 simulations every 2 periods that the data is saved. Then you can graph this data over time using Excel or Vensim. Figure 2 in the paper shows the final graph using Vensim. Table 2 summarizes the same data.
After changing the parameter "Random Initial Switch" from 1 to 0, you can repeat the same procedure to calculate the data reported in the table in footnote ix.

The Impact of Delays

To avoid long running time, go to Model>Settings and change the SAVEPER to 239. Then run a sensitivity analysis using the following sensitivity control code:

200,M,1234
XPayoff Noise Seed=VECTOR(1,200,1)
Time to Influence Payoff[a1]=VECTOR(0,16,2)

Use the following Save List:

Acheived to optimal payoff percentage
Convergence Time

Export the results at the final time into a .TAB file and open it with excel. Now you will need to summarize each block of 200 runs into 1 number. For this purpose, the excel file: "TimeSensitivity.xls" contains the macro "complete 2" which does the required computations. You should adjust the file paths and names in the macro, so that it can read the correct .TAB file and can save the result in an existing directory.

In the final file, there will be an extra column of data, with subscript "Div", repeating as the 4th column in the summary, which is not used in the paper analysis and that you can ignore. You can now graph the summarized "Achieved to optimal payoff percentage" as well as "Convergence Time" and "Percentage Converged" via different payoff generation delays (Time to Influence Payoff[a1]) and recover the graphs in Figure 3 of the paper.

Robustness of Results Analysis

First make the following changes in the parameter values and model settings:

- Set the SAVEPER to 239
- Change the parameter "sensitivity is on" from 0 to 1
- Change the parameter "Uniform Random Sensitivity Switch" from 0 to 1

Now use the following sensitivity control code to run the sensitivity analysis over the main parameters. If the simulation time is too long, break the simulation into smaller

chunks of 200-500 simulations, each chunk with a different random noise seed, and add all the data together at the end.

3000,M,91
XPayoff Noise Seed=RANDOM_UNIFORM(1,100)
Random initial seed1=RANDOM_UNIFORM(0,100)
Random initial seed2=RANDOM_UNIFORM(0,100)
Action Lookup Time Horizon=RANDOM_UNIFORM(2,10)
Correlation Time Factor=RANDOM_UNIFORM(0,2)
Perceived Time To Influence Payoff[a1]=RANDOM_UNIFORM(0,16)
Time to Influence Payoff[a1]=RANDOM_UNIFORM(0,16)
Parameter Base Level 1[p1]=RANDOM_UNIFORM(0.05,0.8)
Parameter Base Level 1[p2]=RANDOM_UNIFORM(1,9)
Parameter Base Level 1[p3]=RANDOM_UNIFORM(4,20)
Parameter Base Level[p1]=RANDOM_UNIFORM(3,17)
Parameter Base Level[p2]=RANDOM_UNIFORM(3,17)
Parameter Base Level[p3]=RANDOM_UNIFORM(3,17)
Parameter Base Level[p4]=RANDOM_UNIFORM(3,17)

Use the following save list:

Acheived to optimal payoff percentage[Rgr]
Acheived to optimal payoff percentage[Crr]
Acheived to optimal payoff percentage[Myo]
Acheived to optimal payoff percentage[Pfr]
Convergence Time[Rgr]
Convergence Time[Crr]
Convergence Time[Myo]
Convergence Time[Pfr]

Export the data into a .TAB file and open it with your statistical package. You can now run different regression analyses over the data and replicate the regression results of tables 4-8. For tables 5-6, multivariate OLS regression is used. For table 7-8, logistic regression is applied to predict convergence probability. In each case you can see what independent variables are used to predict the dependent variable from the tables. Note the following changes in variable names in the tables compared to their corresponding names in the model:

Paper	**Model**
Payoff Generation Delay [a1]	Time to Influence Payoff[a1]
Absolute Perception Error	| Time to Influence Payoff[a1] – Perceived Time to Influence Payoff[a1]|
Log (Correlation Time)	Log(Action Noise Correlation Time)
Value Adjustment Time	Time to Change Action Value
Reinforcement Forgetting Time	Time to Forget Reinforcement

Also note that “Parameter Base Level” and “Parameter Base Level 1” are used to change some of the parameters in the attached model. The following table guides you through these settings and helps you in reading the results of the analysis.

Parameter Name in Paper	**Parameter Changed in Analysis**
Correlation Slope at Origin	Parameter Base Level 1[p1]
Evaluation Period	Parameter Base Level 1[p2]
Reinforcement Power	Parameter Base Level 1[p3]
Value Adjustment Time[Regression]	Parameter Base Level[p1]
Value Adjustment Time[Correlation]	Parameter Base Level[p2]
Value Adjustment Time[Myopic Search]	Parameter Base Level[p3]
Reinforcement Forgetting Time	Parameter Base Level[p4]