Matlab data files, analysis scripts and computational model for:

**Dopamine-dependent loss aversion during effort-based decision-making**

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**What do you want to do?**

1. **I want to reproduce the analyses from the paper.**

**The analyses are organised by the order of the main figures (as indicated by the titles of the folders/files). Please check folders/files named Figure1, Figure2, … Figure5.**

If you run these files named **Figure1.m, Figure 2.m, … Figure 5.m** from within their current directory, it should reproduce all of the figures from the paper. For more information regarding the figures, please refer to the figure captions in the paper and the comments within the code file.

1. **I want to play with modelling analysis.**

**The effort-discount models can be found in folder ‘ParameterEstimation’**

**The main file is in ‘main.m’, where the** fmincon **and** MultiStart **functions are used to minimise the objective function defined in ‘ModelLog.m’**

‘choose\_a\_model.m’ is called by ‘main.m’ to specify the model type. For example, a Linear discounting function with separate discounting parameters for the reward and punishment conditions.

1. **I want to play with the raw data.**

**Check folders named ‘Data’**

**For each subject, there are four ‘.mat’ files.**

**xxx=subject ID**

**‘Effort\_Sxxx\_block\_1\_stage\_3.mat’ and ‘Effort\_Sxxx\_block\_2\_stage\_3.mat’:** These are two blocks of trials (reward and punishment trials), the order of which was counter-balanced across participants. Each block consisted of 10 repetitions of each of the 6 force levels, with a total of 60 trials in each block (15 repetitions for the young age group, 90 trials in each block).

Each file contains a structure named ‘Data’ that has 45 fields. The fields that are relevant to participant behavioral data are listed below.

**Data.condiOrders**: the order of these two blocks. For example, [1,2] means reward block first and then punishment block (1==reward, 2==punishment).

**Data.nTrials**: the number of trials in each block.

**Data.percentageForce**: the six force levels used.

**Data.condition**: This block is a ‘Gains’ (or ‘Losses’) condition.

**Data.forcePointCombo**: N cells (N= the number of trials in this block); Each cell is for one trial, providing the force levels (from 1 to 6), and the points offered for this force level. [0,0,6,31] means the participants were asked if they are willing to produce forceLevel 6 for 31 points. The first two zeros were not used.

**Data.forces**: N cells (N= the number of trials in this block) for N trials. Each cell contains a Mx14 matrix. M is the number of data sample on each trial. 14 columns are the data recorded using this specific equipment. The example of using this data can be found in Figure2 folder Execution1.m (the file is to plot the force trace for each participant). The first 7 columns are for force handle1; the second 7 columns are for force handle2. Depending the assignment, one handle is the decision-making handle and the other one is the handle used to produce the required force on each trial.

**Data.DataTimeStamp**: this one has the same structure as **Data.forces.** It provides the time-stamps for each data sample (from the beginning of each trial).

**Data.responseTime**: Nx1 (N= the number of trials in this block). Response time is defined as the time between the offer displayed on the screen and the choice made by the participants.

**Data.reactTime**: Nx1 (N= the number of trials in this block). React time is defined as the time between the choice made by the participants and the force cursor left the home box (i.e., participants started producing force).

**Data.rampupTime:** Nx1 (N= the number of trials in this block). Ramp-up time is defined as the time between the force cursor left the home box (i.e., participants started producing force) to the force cursor stayed at the required force level.

**Data.choice:** Nx1 (N= the number of trials in this block). The choice made by the participants (1=Yes, 2=No).

**Data.valid:** Nx1 (N= the number of trials in this block). 1=valid; 0=invalid trial. Invalid trials includes the trials where (1) participants choose to produce the force, but failed to do so; (2) no responses were made 20s after the offer displayed.

**Effort\_Sxxx\_MVF.mat:** Before the main effort-based decision-making task, participants were asked to produce a maximal voluntary contraction (MVC) of their first dorsal interosseous (FDI) muscle (isometric contraction of the index finger against the handle) for 3 seconds. This was repeated 3 times. The data is saved in this file.

**Effort\_Sxxx\_MVF\_post.mat:** Following the main effort-based decision-making task, participants were asked to produce 3 consecutive 3-second MVCs again. The data is saved in this file.

These two files have similar structure as the main data file. The data we were interested was Data.Forces.

1. **I want to do something that is not listed here (or I want to report a bug…).**

If you have questions that aren’t addressed in this readme file, or by looking directly at the MATLAB code, feel free to get in touch chenxy@bham.ac.uk. I will try to help wherever possible, although I may not be able to respond to every request.