Effort Expenditure for Rewards Task

This README file describes the process for running the Effort Expenditure for Rewards Task as initially described in (Treadway, Buckholtz, Schwartzman, Lambert, & Zald, 2009). Note that some minor modifications have been made to improve functionality and clarity.

SYSTEM REQUIREMENTS:

- Standard Mac or PC computer
- Standard desktop keyboard – NOT a laptop or tablet keyboard
- Matlab 2007b or later
- Psychtoolbox version 3.0.9 or later installed and added to the matlab path.

INSTALLATION

- Download the "EEfRT_Standard_v3" folder to a location on your computer from which you want to run the task.
- Add the EEfRT_Standard_v3folder to your matlab path.

START TASK

- Set screen resolution to 1280 X 1024 (or closest available approximation)
- To launch the task, open Matlab. In the command line, type "RunTrials".

- This will launch a dialogue window with prompts for the following information:

Subject number: Enter a unique identifier for each subject. Numbers only.

Handedness: Enter 'r' or 'l' to indicate subject handedness.

Practice Trials: Enter 'y' or 'n' to have subjects read instructions and complete 3 practice trials. This should ALWAYS be 'y' when participants are completing the task for the first time in a given session. It can be 'n' if the task is re-administered within a session.

Session: Enter a number to identify session number. Numbers only.

INSTRUCTIONS AND PRACTICE:

If you selected 'y' for practice trials, the subjects will then be presented with a series of instructions. The experimenter should be available while these are read to answer any questions. When these are finished, the screen will display "Wait for the experimenter" and the experimenter should to ask following:

Do you have any questions about the task?

Do you feel clear on what the different probabilities signify?

[If No] *They signify the probability that you will win money on a given trial if you complete either the easy or hard task for that trial. Every trial will either have an 88% a 50% or a 12% probability of winning.* [EMPHASIZE THAT PROBABILITY APPLIES TO EASY AND HARD TRIALS].

Are you clear on how you will be paid for trials on this task?

[If No] *So even though you are playing for money on each trial, only some of the trials that you win money for will actually be paid to you at the end. Those trials will be chosen randomly at the end of the experiment. So we want you to treat every trial as if it could count. ?* [NB: THIS MAY NEED TO CHANGE DEPENDING ON YOUR STUDY]

After the instructions are explained, begin practice trials.

You will now play four practice trials. For the first two trials, I will tell you which to choose. For the last two, you will have an opportunity to choose.

[Have the subject press any key to advance to practice trials.]

Tell subject get their hands in position.

For the first trial, instruct the subject to choose the easy task. As they begin to complete the task say:

This is the easy task. You want to press the [l or s] *key until the bar gets to the top before the timer runs down. Afterwards you get feedback on whether you completed the task, and the feedback on whether you won money for that trial.*

For 2nd practice trial, instruct subject to choose hard task, and walk them through completing the hard task. As before, make sure to point out each step of the task.

This is the hard task. You want to press the [l or s] *key until the bar gets to the top before the timer runs down. Afterwards you get feedback on whether you completed the task, and the feedback on whether you won money for that trial.*

Then instruct subjects to make a choice for each of the last 2 trials. If the subject takes a long time, you may need to remind them that the choice period lasts only 5 seconds.

After they have completed the practice trials, there will be a pause. Ask the subject if they have any questions. If not, proceed as follows:

Ok. Good. A few final things to keep in mind:

You only have five seconds to make a decision, if you do not make a decision in that time you will be randomly assigned to either the easy or hard task for that trial.

We may check-in on you periodically to make sure you are performing the task correctly. If you do this, we won't be able to give you [credit/money] for participating. Make sure you do not switch fingers for the hard task, and make sure you do not intentionally fail to perform any tasks that you chose.

You will now play the game for 20 minutes. How many trials you get through in that time will be up to you, as the hard-task takes twice as long as the easy task. On the one hand, the more hard trial choices you make, the more likely it is that your incentive trials will be worth more than $1. On the other hand, the more hard-task trials you choose the fewer trials you will get through overall, and so you may miss out on some high-value, high-probability trials that come later on.

MAIN TASK

After the practice trials have been completed (or if you selected 'n' for practice trials) the task will again display "press any key to continue". The program will then initiate the 102 trials of the actual task. In a 20-minute session, most subjects complete between 48-70 trials, depending on how many hard-task choices they make.

STOPPING/RE-STARTING

If you need to interrupt the task at any point, simply press "CTRL" and "C" at the same time (these keys are the same for both PCs and MACs). You may need to do it more than once. This should pause the task.

After the task has been paused, hit return a few times, type "sca" and hit return once more. This should close the task window and return you to the matlab command window.

COMPLIANCE/CHEATING

Cheating is not common on the EEfRT, but does occur. In our prior studies as well as reports we have received from other groups, we estimate that in a given sample 2%-7% of subjects may attempt to cheat, depending on the nature of the study population.

To mitigate the effects of cheating, the experimenter **MUST** be able to monitor the participant occasionally to make sure that s/he has not switched fingers and is otherwise complying with the task. As described in the instructions, common types of cheating are switching fingers, letting the computer choose, and intentionally failing trials.

OUTPUT

After the task is completed, the script will write a file call "EEfRT_Data[Subj#]_Session[#].dat". to the EEfRT/DATA directory.

The first 4 trials of this output file represent the practice trials. These trials should NOT be included for analysis. The trials for the actual task begin with a reward value of $3.04 and a probability of 12% and will appear on line 5 or 6 of data file depending on whether you include a header row.

It will also write a text file with the subject's earnings based on two randomly selected trials.

INTERRUPTING THE TASK

If you need to interrupt the task, the best way is to use "Ctrl C" and then type "sca", a psychtoolbox command for "Screen close all" that should close out the task window.

NOTES ON DATA QUALITY

Reaction Time:

- When a subject fails to make a choice within the allotted amount of time (typically 5s for most version of the task), it is considered a "time out" and the value in the RT column will be 0. Because the subject did not make a choice on these trials, these trials should NOT be included in analysis.

- Most subjects can be expected to "time out" (i.e., RT = 0) on 0-2 trials per administration of the EEfRT. However, if a subject times out on more than ~10%-20% of trials, it may be worth considering the exclusion of that subject. At a minimum, it is recommended that you examine the influence of that subject on all analyses.

- Because there is a set temporal window for making a choice RT is generally not considered as a primary dependent variable of interest, nor is it usually included as a covariate. However, this may vary depending on the purpose of the study.

Choice Completion Rate:

- When a subject fails to make the required number of button presses in the allotted time for either the Easy or Hard Task (typically 7 and 21 s, respectively), it is considered a failed trial and the value in the Completion column will be 0. Because these trials do represent valid choices, it is fine to include them for the purpose of analyzing choices.

- It is not uncommon for subjects to fail on 1-2 trials. Subjects that fail on 10-20% of trials should be considered for exclusion.

NOTES ON ANALYSIS AND INTERPRETATION

As originally designed (Treadway, et al., 2009), the primary dependent variable of the task is the total proportion of Hard task choices made within the 20 minute period. This can be analyzed using mean proportion measures (e.g., ANOVAS or T-tests) or using trial-level models (logistic regression, GEE, etc.). The primary interpretation of this metric is the willingness to expend effort for rewards.

In addition to the proportion of high effort options, one can also examine individual differences in effort allocation strategy. I.e., to what extent individuals utilize trial-wise information regarding the magnitude of reward for the Hard task or the probability of winning. These questions are somewhat distinct from the overall willingness to choose the Hard task, and speak the extent to which the subject is able to develop a rational and consistent strategy for allocating effort during the task. This type of analysis can be performed by binning the proportion of Hard task choices based on relevant categories (probability level, reward level, etc.),

comparing parameters associated with reward magnitude or probability from individual logistic models, or using a computational modeling framework (Cooper, et al., 2018)

It should be noted that a proportion of subjects may exhibit a pattern of choosing all Easy or all Hard choices (aka "single responders"). Single responders must be treated with care, as they can exert significant influence on primary questions of interest. While we generally recommend against exclusion of otherwise valid data, we recommend that primary analyses of interest should be run with and without single responders to ensure that they are not responsible for creating (or suppressing) an important effect in the data.

Finally, it should be noted that many variants to this task now exist, and these should be taken into consideration when comparing results across studies. For example, a number of studies use a version with two probability levels instead of three (Barch, Treadway, & Schoen, 2014; Reddy, et al., 2015) and others used a fixed amount of trials rather than a fixed amount of time (Damiano, Aloi, Treadway, Bodfish, & Dichter, 2012) and still others varied the length of time for making a choice, the total amount of time for task, the process for compensation subjects, and the use of a fixed vs. individualized level of difficulty (i.e., customized number of required button presses). We encourage researchers to carefully consider the types of variations that may be most appropriate for their study question and population.

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