Safe models for risky decisions

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Appendix D

Appendix to Chapter 5: "Absolute Performance of Reinforcement-Learning Models for the Iowa Gambling Task"

D.1 Recipe for Obtaining Choice Probabilities According to the Post Hoc Absolute Fit Method

1. For a given participant i, take a random draw from the individual-level joint posterior (i.e., use a random chain and iteration). This random draw results in a parameter value combination (i.e., $\{w_i, A_i, a_i, c_i\}$ for the PVL and the PVL-Delta models, and $\{w_i, a_i, c_i\}$ for the EV model) that is then provided to the model. Alternatively, use the maximum likelihood estimates.

2. Initialize the expectancies of all decks to zero, $Ev_k(0) = 0$. Therefore, $P[S_k(1)] = 0.25$ for each deck k, $k \in \{1, 2, 3, 4\}$ (i.e., on the first trial, all decks are equally likely to be chosen).

3. Execute steps $4 - 7$ for trial $t = 1$ up to and including $t = T - 1$ where T is the maximum number of trials used in the corresponding experiment.

4. Provide the model with the observed choice $S_k(t)$, and payoff on trial t, $W(t)$ and $L(t)$.

5. Use the payoff observed on trial t to compute the utility of the chosen deck.

6. Update the expected utility of all decks (or only of the chosen deck, in the case of the EV and PVL-Delta models).

7. Compute the probability that deck k will be chosen on the next trial $P[S_k(t + 1)]$. Save the probabilities.

8. Repeat steps $1 - 7$ for each subject 100 times to account for the posterior uncertainty. This step is omitted if maximum likelihood estimates were used.

D.2 Recipe for Obtaining Choice Probabilities According to the Simulation Method

1. For a given participant i, take a random draw from the individual-level joint posterior (i.e., use a random chain and iteration). This random draw results in a parameter value combination (i.e., $\{w_i, A_i, a_i, c_i\}$ for the PVL and the PVL-Delta models, and $\{w_i, a_i, c_i\}$ for the EV model) that is provided to the model. Alternatively, use the maximum likelihood estimates.

2. Initialize the expectancies of all decks to zero, $Ev_k(0) = 0$. Therefore, $P[S_k(1)] = 0.25$ for each deck k, $k \in \{1, 2, 3, 4\}$ (i.e., on the first trial, all decks are equally likely to be chosen).

3. Execute steps $4 - 7$ for trial $t = 1$ up to and including $t = T - 1$ where T is the maximum number of trials used in the corresponding experiment.

4. Generate a choice on trial t using $P[S_k(t)]$.

5. Use the payoff corresponding to the choice on trial t to compute the utility of the chosen deck. Make sure to use the same payoff schedule as in the corresponding experiment.

6. Update the expected utility of all decks (or only of the chosen deck, in the case of the EV and PVL-Delta models).

7. Compute the probability that deck k will be chosen on the next trial $P[S_k(t + 1)]$. Save the probabilities.

8. Repeat steps $1 - 7$ for each subject 100 times to account for the posterior uncertainty. This step is omitted if maximum likelihood estimates were used.