# Supplementary Information for When to stop social learning from a predecessor in an information-foraging task

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#### 1. The demonstrator's (computer agent's) model

## 1.1. Overview

To set human-like parameters for the demonstrator (computer agent), we conducted a pilot experiment in which another set of participants worked on the same task online. Ninety-one students at the University of Tokyo (32 females; Mean age  $\pm$  S.D. = 23.0  $\pm$  1.9) worked on the same 30-armed bandit task as used in the main experiment for 100 trials individually without social information. After finishing the experiment, participants were compensated according to their task performances (Mean  $\pm$  S.D. = 1284  $\pm$  119 JPY).

### 1.2. Models

To develop a model that represents the average behavior of human participants reasonably well, we fitted a series of reinforcement learning models (Sutton & Barto, 2018; Wilson & Collins, 2019) to the behavioral data and estimated behavioral parameters for each participant. In the full model, participants update the expected reward of option k in response to reward r according to the Rescorla-Wagner learning rule:

$$Q_{t+1}(k) = Q_t(k) + \alpha (r_t - Q_t(k)),$$
(1)

where  $\alpha$  is the learning rate that takes a value between 0 to 1. We treated the initial value of each option,  $Q_0 = q_{\text{init}}$ , as a free parameter. In order to take account of forgetting effect, we assumed that the values of unchosen options  $\bar{k}$  return to the initial value according to the following equation:

$$Q_{t+1}(\bar{k}) = Q_t(\bar{k}) + (1 - \alpha_f) \left( q_{\text{init}} - Q_t(\bar{k}) \right), \tag{2}$$

where  $\alpha_f$  is the forgetting rate. This is a free parameter which ranges from 0 to 1. When  $\alpha_f = 1$ , there

is no forgetting effect. When  $\alpha_f = 0$ , the values of unchosen options immediately return to the initial value.

The overall valuation function consists of the expected reward and the correction term of the UCB1 (Upper Confidence Bound) score as follows:

$$V_t(k) = Q_t(k) + \tau \cdot \sqrt{\frac{\log t}{T_t(k)}},\tag{3}$$

where  $T_t(k)$  is the frequency of choosing option k so far, and  $\tau(>0)$  is a free parameter that governs the degree to which uncertainty is prioritized relative to the expectations of reward.  $\tau$  can be interpreted as the uncertainty premium of each participant. In other words, when  $\tau$  is greater, exploration becomes more directed to novel options.

The probability of choosing option k is produced according to the softmax choice rule:

$$P_t(k) = \frac{\exp(\beta \cdot V_t(k))}{\sum_{i=1}^{30} \exp(\beta \cdot V_t(i))},\tag{4}$$

where  $\beta(>0)$  is the 'inverse temperature' parameter that controls the level of stochasticity in the choice, ranging from  $\beta = 0$  for completely random responses to  $\beta = \infty$  for deterministically choosing the option with the highest value.

Overall, the full model has five free parameters:  $\alpha$ ,  $\alpha_f$ ,  $\beta$ ,  $\tau$ , and  $q_{init}$ . The prior distributions for each parameter were defined as follows:

$$\alpha \sim \text{Beta}(2,2) \tag{5}$$

$$\alpha_{\rm f} \sim \text{Beta}(2,2)$$
 (6)

$$\beta \sim \text{Gamma}(2,1/3) \tag{7}$$

$$\tau \sim \text{Cauchy}^+(0,10) \tag{8}$$

$$q_{\rm init} \sim \text{Gamma}(9.5,10) \tag{9}$$

We considered seven sub-models in addition to this full model (see Table S1). These models include those in which  $q_{init}$  is fixed at 95 (i.e., the expected reward for one random choice), those in which  $\tau$  is fixed at 0 (so the participant's uncertainty premium is not considered), and those in which  $\alpha_f$  is fixed to 1 (so there is no forgetting effect). By comparing these models, we aimed to identify a computational model that simulates the behaviours of human participants reasonably well.

#### 1.3. Fitting procedure

We estimated individual parameters with the Markov Chain Monte Carlo (MCMC) method using Stan 2.31.0 (https://mc-stan.org) in R. The models contained at least four parallel chains, and we confirmed convergence of the MCMC with the Gelman-Rubin statistics  $\hat{R} < 1.1$ . We calculated WBIC from MCMC samples for each model-participant combination and determined the approximate goodness of fit for each model by summing these values for all participants. To identify the globally best-fitting model, we derived the Widely Applicable Bayesian Information Criterion (WBIC; Watanabe, 2013) for each participant-model pair from the MCMC samples.

## 1.4. Modelling results

The result of the model comparison is summarized in Table S1. According to the sum of estimated WBICs, the full model (No. 8) fit the behavioural data best. We then calculated the median of the maximum a posterior probability (MAP) estimates of the five behavioural parameters under the full model and designated the median estimates as the behavioural parameters of the demonstrator to be implemented in the main experiment. We confirmed that the performance of the computer agent (demonstrator) is approximately equivalent to that of the average human participant in the pilot experiment (t(210) = 1.26, d = 0.16, 95% CI [-0.09, 0.40], p = .209; Fig. S1).

| Model        | $q_{ m init}$ | τ | $lpha_{ m f}$ | Sum of WBIC |
|--------------|---------------|---|---------------|-------------|
| 1            |               |   |               | 14475       |
| 2            | Х             |   |               | 13587       |
| 3            |               | x |               | 14312       |
| 4            | Х             | x |               | 13503       |
| 5            |               |   | x             | 14451       |
| 6            | X             |   | x             | 13443       |
| 7            |               | x | x             | 14421       |
| 8 (full mode | el) x         | х | х             | 13282       |

Table S1. Result of the model comparison. The middle three columns indicate which free parameters were included in each model.



**Fig. S1.** Behavioral performance of the demonstrator. (a) Learning curves of the demonstrator (computer agent) and human participants. Each curve shows mean reward of the 185 demonstrators implemented in the main experiment, and mean reward obtained by the 91 participants in the pilot experiment. Trials in which the participants in the main experiment could not observe the preceding demonstrator's behavior were shaded in gray. The vertical dashed line indicates the trial (i.e., the 30th trial for the demonstrator) after which the participants in the main experiment could switch to independent trials any time. (b) Behavioral performance of the demonstrator (in the main experiment) and the participants in the pilot experiment, in terms of the quality of chosen option, which ranges from 1 (choosing only the worst-category options) to 6 (choosing only the best-category option). There was no significant performance difference between the demonstrators and the participants (t(210) = 1.26, d = 0.16, 95% CI [-0.09, 0.40], p = .209).

## 2. Timing of independence



**Fig. S2.** Distribution of the timing of independence. 38 (61.3%) participants in the Choice-only condition, 31 (50.0%) in the Reward-only condition, and 44 (72.1%) in the Choice-plus-reward condition switched to independence right after the mandatory independence phase was over (i.e., the 16th trial).

## 3. Individual learning curves of all demonstrator-participant pairs

Individual learning curves of all participant-demonstrator pairs are shown in Figs. S3-5. The x-axis refers to 100 trials in the experiment (Fig. 1). The solid lines are derived from nonparametric regression analysis with locally estimated scatterplot smoothing (LOESS).

Choice-only condition



Fig. S3. Individual learning curves of all demonstrator-participant pairs (Choice-only condition).

## Reward-only condition



Fig. S4. Individual learning curves of all demonstrator-participant pairs (Reward-only condition).

Choice+Reward condition



Fig. S5. Individual learning curves of all demonstrator-participant pairs (Choice-plus-reward condition).

## 4. Proportions of choosing each of the 30 options

Figs. S6-8 show proportions of the demonstrator's choices in observational trials (left) and the participant's choices in independent trials (right) over the 30 options. The number above each panel indicates the IDs of the demonstrator-participant pairs in each condition. The locations of the 30 options were identical to those in the experiment. The number in each grid represents the average reward of the option.

# Choice-only condition

Choice proportions

0.25 0.50 0.75 1.00

| 1         25           120         150         120         90         105         75           150         90         90         75         105         75           75         75         105         133         105         155           90         90         90         75         105         120           75         90         90         75         105         120           75         90         90         75         105         120           75         90         75         105         105         90   | 1         100         150         12.0         90         135         75           75         90         90         75         105         75           75         75         105         105         105         75           90         90         75         105         105         105           90         90         75         105         105         105           90         90         75         105         75         100           75         90         75         105         90         75         105   | 2         2           75         90         135         75         120           90         90         75         75         75         120           105         90         90         75         75         75         120           105         90         90         75         90         75         105           105         105         75         90         125         105  | 2         2           75         90         90         130         75         120           105         90         75         75         75         75         100           105         90         70         75         75         75         75         105           105         75         75         90         75         105         105           75         90         120         135         90         105   | 3         30           90         150         90         76         120         90           135         75         90         76         75         105           90         150         150         90         90         90           120         75         150         90         90         90           100         75         75         105         120         75  | 3           90         150         90         75         120         90           15         75         90         75         105         105           90         75         155         90         90         90         105         105           100         75         105         105         75         105         105           100         75         75         105         105         105         105  | Here         Here           105         90         75         90         75           90         75         105         75         75           90         75         90         75         90           75         75         90         75         90           76         75         90         75         90           120         136         160         120         105         105  | 4           105         90         75         90         75           90         75         90         75         90           90         75         105         120         75           90         75         90         75         90           75         90         75         90         75           120         135         136         120         108  | S           | Solution         Solution |
|--|---|--|---|--|---|---|--|---|---|
| 6           75         75         76         120         90           05         75         75         15         105           90         105         90         90         15         105           90         105         90         75         75         105           75         105         120         75         135         105           75         105         120         75         135         105  | 6         9           75         75         75         76         100         90           105         90         90         92         75         105           90         105         90         75         75         120           75         105         120         75         135         105           90         105         90         75         135         105           75         90         135         75         90         105   | 7         90         75         76         90           105         75         75         90         90         90         90         90         90         90         90         90         90         90         90         90         120         120         120         90         105         75         90         90         90         90         105         105         90         105          | 75         90         75         90           105         75         75         75         90           90         120         120         120         90           75         75         105         135         90           100         120         120         120         90   | 8           75         90         75         100         75         75         75           105         75         75         75         120         135           120         90         75         75         120         135           90         90         120         105         105         105  | 8         75         90         75         150         105         75           105         75         75         75         120         135           120         90         75         75         120         135           90         90         75         90         90         135           90         90         120         105         105         105  | 9         100         90         75         105         100           90         106         90         75         120         75         75           75         75         120         75         75         120         75           75         155         90         90         105         120           75         125         90         90         105         120           75         125         90         90         105         120           75         125         90         90         105         120   | 9         Participant           90         105         90         75         105         150           75         75         120         75         5         5           75         75         135         90         105         120           75         120         90         90         105         120           75         120         90         90         105         120   | 10         90         90         105         75         120           120         90         90         105         75         105         105           105         75         135         150         90         105         135           105         75         135         150         90         155         105           105         75         90         75         90         75         90         75   | 10         75         120           120         90         90         105         75         120           75         75         75         75         75         105           105         75         135         150         90         105           105         75         90         75         90         75           90         90         90         105         105         105           105         75         90         75         90         75           90         75         90         90         105         120  |
| 12         75         90         105         75           90         120         75         90         105         75         75           105         105         75         75         75         105         75         105           105         105         75         75         105 <td>11           Participation           90         120         50         90         105         75           90         120         105         75         75         75         105           105         105         75         75         75         105</td> <td>12           105         75         90         90         75         75           105         75         90         90         150         160           105         75         90         90         150         160           105         75         90         90         150         160           105         75         135         90         75         135           105         75         135         90         90         150           105         75         135         90         90         150</td> <td>12           105         75         90         90         75         75           75         120         75         90         90         150           105         75         90         90         75         150           105         75         90         90         75         150           105         75         135         90         90         75           105         75         136         90         90         75</td> <td>13           90         120         90         75         135         75           135         90         105         75         150         90           90         150         75         120         90         105           90         150         75         120         90         105           90         75         75         105         120           90         75         75         105         120           90         105         105         105         120</td> <td>13           Participant           120         0         75         135         75           135         90         105         75         75         90           100         150         75         120         90         105           90         75         75         105         120         105           90         75         75         105         120         105           90         75         75         105         120         105           90         75         75         105         120         105           90         75         75         75         105         120           90         75         75         75         105         120           90         75         75         75         105         120           90         75         90         105         105         75</td> <td>14           135         00         105         00         100           135         00         155         90         90           07         150         150         90         100           75         150         120         90         105           75         90         120         75         150           75         75         75         120         75</td> <td>14           Participant           135         90         105         90           97         75         105         90         105           97         75         105         120         90           75         90         120         75         105           75         90         120         75         105           75         75         75         75         120         75</td> <td>15           105         90         105         75           105         90         90         105         75           120         90         120         90         125           90         75         90         120         90         125           90         75         90         120         90         125           90         75         90         120         75         125</td> <td>15           Participation           105         90         105         75           136         105         105         75         75           138         105         105         75         75           100         90         120         90         101         135           90         75         90         150         75         75           75         90         75         120         75         105</td> | 11           Participation           90         120         50         90         105         75           90         120         105         75         75         75         105           105         105         75         75         75         105 | 12           105         75         90         90         75         75           105         75         90         90         150         160           105         75         90         90         150         160           105         75         90         90         150         160           105         75         135         90         75         135           105         75         135         90         90         150           105         75         135         90         90         150  | 12           105         75         90         90         75         75           75         120         75         90         90         150           105         75         90         90         75         150           105         75         90         90         75         150           105         75         135         90         90         75           105         75         136         90         90         75   | 13           90         120         90         75         135         75           135         90         105         75         150         90           90         150         75         120         90         105           90         150         75         120         90         105           90         75         75         105         120           90         75         75         105         120           90         105         105         105         120   | 13           Participant           120         0         75         135         75           135         90         105         75         75         90           100         150         75         120         90         105           90         75         75         105         120         105           90         75         75         105         120         105           90         75         75         105         120         105           90         75         75         105         120         105           90         75         75         75         105         120           90         75         75         75         105         120           90         75         75         75         105         120           90         75         90         105         105         75  | 14           135         00         105         00         100           135         00         155         90         90           07         150         150         90         100           75         150         120         90         105           75         90         120         75         150           75         75         75         120         75  | 14           Participant           135         90         105         90           97         75         105         90         105           97         75         105         120         90           75         90         120         75         105           75         90         120         75         105           75         75         75         75         120         75  | 15           105         90         105         75           105         90         90         105         75           120         90         120         90         125           90         75         90         120         90         125           90         75         90         120         90         125           90         75         90         120         75         125   | 15           Participation           105         90         105         75           136         105         105         75         75           138         105         105         75         75           100         90         120         90         101         135           90         75         90         150         75         75           75         90         75         120         75         105   |
| 16           Demonstratori           105         900         75         75         90           75         90         90         75         155         90           90         90         75         75         150         105           90         90         75         75         150         105           105         135         120         120         75         105  | 16         Participant           105         90         75         75         90         75           75         90         90         75         105         120           75         75         90         75         135         90           90         90         75         75         105         105           105         136         120         75         150         105   | 17           Demostrator           105         125         75         120         105           75         105         75         90         105         90           75         106         75         90         105         90           90         120         75         90         120         90           75         75         75         135         120   | 17           Participant           105         135         75         150         105           75         105         75         90         105         90           75         105         75         90         105         90   | 18           Demonstrator           90         75         90         120           75         75         90         120         120           150         75         120         90         75         120           160         75         90         100         90         155           105         75         90         105         90         135           75         75         106         75         106         90   | 18         20         12           90         75         90         75         90         120           75         75         90         120         100         120           160         75         125         90         75         120           100         75         125         90         75         120           75         75         105         90         75         120  | 19           Dependence           105         75         135         75         136         75           150         105         75         136         75         136         75           90         90         105         75         106         75         106         75           90         90         75         75         120         75         120         75  | 19           Participanti           105         75         135         75           105         75         135         75         136           90         90         105         75         105         75           90         90         105         75         105         75           120         90         90         105         75         120   | 20           Demostrator           105         75         90         75         105           135         75         75         120         120         90           105         105         106         75         90         75         105           105         75         150         75         90         120         75           150         75         90         90         90         90         90   | 20         21           105         75         90         75         105           135         75         75         120         120         90           105         75         75         90         75         120         120         90           105         105         105         75         90         75         120         120         90           105         75         133         75         90         120         75         120  |
| 21           120         90         75         105         75         75           75         90         105         75         105         75           75         105         75         90         120         90         120           90         75         135         90         75         90         120           90         75         136         90         75         90         120           90         75         136         90         75         90         120  | 21           Participanti           120         90         75         105         75         75           75         90         105         75         105         75         105           75         105         175         90         105         75         105           90         75         135         120         75         90         120           90         75         136         90         75         90         120           90         75         136         90         75         90         105  | 22           Demonstrator           90         90         75         105         120         90           105         120         125         75         105         125           135         75         90         75         90         105           75         75         90         75         75         105           90         150         90         75         75         105  | 22           varia         varia <thvarian< th="">         varia         <thvaria< th="">         varia         varia<!--</td--><td>23           Demonstrate           105         90         90         150         165           75         75         76         90         90         75           90         120         120         90         90         75           75         75         100         100         75         75           75         75         100         100         75         75</td><td>23         23           Participanti         100         100         100           100         90         100         100         100           100         100         100         100         100         100           100         100         100         100         100         100         100           100         100         100         100         100         100         100         100</td><td>24           Deconstruction           150         75         105         105         75           90         90         90         75         105         105           75         75         75         135         15         105           75         90         90         105         90         105           90         105         90         135         120         120</td><td>24           varia         varia           150         75         105         105         75           90         90         90         75         120         75           75         75         75         135         75         105           76         90         90         105         90         105           90         105         90         105         90         105</td><td>25           Dermonstrature           105         90         105         75         90           90         90         120         105         75         105           76         90         120         105         75         90           105         75         75         135         90         75           106         75         75         135         90         75           120         75         75         130         90         75</td><td>25           Data         Data</td></thvaria<></thvarian<> | 23           Demonstrate           105         90         90         150         165           75         75         76         90         90         75           90         120         120         90         90         75           75         75         100         100         75         75           75         75         100         100         75         75   | 23         23           Participanti         100         100         100           100         90         100         100         100           100         100         100         100         100         100           100         100         100         100         100         100         100           100         100         100         100         100         100         100         100   | 24           Deconstruction           150         75         105         105         75           90         90         90         75         105         105           75         75         75         135         15         105           75         90         90         105         90         105           90         105         90         135         120         120   | 24           varia         varia           150         75         105         105         75           90         90         90         75         120         75           75         75         75         135         75         105           76         90         90         105         90         105           90         105         90         105         90         105   | 25           Dermonstrature           105         90         105         75         90           90         90         120         105         75         105           76         90         120         105         75         90           105         75         75         135         90         75           106         75         75         135         90         75           120         75         75         130         90         75   | 25           Data   |
| 26           Demonstrator           0         05         105         175         90           150         75         105         90         120         75           90         105         155         75         100         90         75           90         135         75         90         120         75           90         136         75         90         120         75           90         136         75         90         120         75           100         105         105         75         75         75  | 26           Participant           90         90         105         105         90           150         75         105         90         120         75           75         75         135         90         90         75           90         106         75         90         120         75           90         106         75         90         120         75   | 27           105         75         75         120         75           90         75         75         120         120         120           90         120         120         150         75         90         125           90         120         120         150         75         90         125         126           90         100         100         150         155         126                                    | 27           Participant           105         75         135         120         75           90         75         75         90         75         59           90         120         120         150         75         90           75         90         135         90         75         90           105         90         135         90         75         90  | 28           Demonstrator           75         90         105         90         90         105           75         75         75         75         90         105           90         75         75         90         75         90           105         75         90         155         90           105         75         105         135         120         150           90         105         120         90         135         75  | 28         28           75         90         105         90         90         105           75         75         75         75         75         90         75           90         75         75         90         75         90         105         90           105         75         105         120         150         100  | 29           Demonstrator           0         75         135         120         75         105           105         75         90         75         150         90           75         90         90         90         135         135           75         105         120         75         105         105           75         105         120         75         105         105           75         105         120         75         105         105           75         105         120         75         105         105   | 29           Participant           10         75         120         75         105           105         75         90         75         150         90           75         90         90         90         135         155         105           75         105         120         75         105         105         105           75         105         120         75         105         105         105  | 30           Demonstrature           120         105         90         75         90         75           75         105         90         90         75         135           120         105         75         136         120         150           75         75         90         75         135         120         150           105         75         75         105         90         90         105         105   | 30           Participant           120         105         90         75         90         75           75         105         90         90         75         135           120         105         75         135         120         150           75         75         90         75         150         90           105         75         75         90         75         150           105         75         75         90         75         105  |
| SI           75         120         90         90         75         105           75         135         75         90         90         150         75           75         135         75         90         105         105         105           75         105         75         90         75         120         105           105         105         135         90         75         75         120  | 31           Participant           75         120         90         90         75         105           120         90         90         90         150         75           75         135         75         90         105         105           75         75         90         75         75         120           105         135         35         90         75         120   | O         105         75         105         75         75         105         75         75         90         90         90         15         75         75         90         90         90         155         75         90         90         90         155         75         90         90         90         150         135         90         90         155         90         90         150         135         90         105 | 32           variation           90         100         75         75           75         75         90         90         75         75           75         90         120         120         90         135           90         75         90         160         135         75           105         105         75         120         90         105  | 33           Demonstrator           75         75         90         105         90           120         75         75         75         135         150           105         105         90         75         90         105           90         90         75         90         90         105           90         90         75         90         90         105  | 33         33           Participant         90         105         90           120         75         75         90         105         90           105         105         90         75         75         105         105           90         90         75         90         90         105         105           90         90         75         90         90         105         105           120         75         75         135         120         75   | Observed         Observed | 34           Darticipanti           105         75         90         75         90           105         75         90         75         105         135           75         75         90         75         105         135           90         75         90         90         75         105           90         75         90         90         75         105           90         75         90         90         75         105  | Spectrum         Spectrum           90         75         90         90         75         75           75         105         105         120         135         90           90         75         105         75         75         155           90         90         90         105         128         120           90         75         105         75         75         120           105         120         120         120         120         120  | 35           Participant           00         75         00         00         75           75         105         100         120         135         90           90         75         105         105         120         135         90           90         75         105         105         120         135         120           105         120         155         155         150         155         150  |
| 36           75         105         90         75         105           75         75         90         90         75         105           90         75         75         75         75         75         75           90         75         75         75         75         75         75         75           90         75         90         90         75         75         75         75           90         90         150         154         120         75         105         120         75           105         120         105         135         120         75         105         120   | 36           75         15         90         75         105           75         75         90         90         75         105           90         75         90         90         75         105           90         75         150         155         120         75           90         90         150         155         120         75           105         120         150         135         120         75   | 37           105         120         75         105         75         75           90         75         75         75         100         75           75         75         90         90         90         15           120         75         75         105         90         105           90         135         105         90         105         105  | 37           105         120         75         105         75           90         75         75         75         90           75         75         90         90         75           120         75         75         150         90           75         75         90         90         90           90         135         105         90         105  | 38         75         90         75         120         7           105         75         90         75         90         75         90         75         90         75         105 | S8         S           105         75         90         75         120         75           105         150         125         75         90         75         90         105           105         150         125         75         90         75         90         105           105         75         90         75         90         75         90         105           105         75         90         75         90         75         90         105         105           100         120         100         90         75         90         90         75   | 39           105         76         105         90         105           75         75         75         120         120         90           75         75         75         120         120         90           75         90         75         120         120         90           90         75         75         120         120         90           90         75         150         90         120         90  | 39           105         75         105         00         105           76         75         75         120         120         90           75         75         75         120         120         90           76         90         75         105         75         135         90           90         75         150         90         120         90         90         90         90         120         90  | 40           90         90         120         76         75           105         90         75         125         90           75         75         105         90           100         75         120         75         105           101         75         75         105         105           102         75         75         105         105  | 40           90         90         90         90         75         75           105         90         90         75         185         90           75         75         120         75         125         90           120         75         75         105         105           135         150         105         90         105         155   |
| H         H           75         75         90         90         75           105         90         90         75         105         90           105         75         90         90         75         105         90           105         75         90         90         75         105         90           105         75         90         90         75         135         75  | 41           75         75         90         90         120         75           105         105         90         75         105         90           105         75         90         90         75         120           106         75         90         90         75         120           106         75         90         90         75         120           107         75         90         90         75         120  | 42           90         90         75         105         75           75         75         105         135         75         90           105         120         75         90         90         105         105           75         75         105         120         75         90         90         105           105         120         75         90         90         105         105           90         90         75         75         105         120         75   | 42           90         90         75         105         76           75         75         105         135         76         90           105         120         75         90         90         105         76           105         120         75         90         90         105         75         90           90         90         75         75         90         102         75   | H3         75         90         75         105         75           105         75         90         75         105         75           75         90         90         120         105         75           90         105         75         125         150         90           75         90         105         75         155         150           90         90         120         90         75         150   | H3         105         75         900         75         105         75         900         120         105         75           90         105         75         100         90         120         100         100           90         105         75         135         150         90         120         100           90         105         75         105         75         75         90         120         100   | 44           150         75         120         100         7           75         75         90         90         105         7           135         135         90         90         105         75         75           75         75         150         90         105         90   | 44           150         75         120         120         105         75           151         75         150         90         105         75           153         135         90         90         90         90         90           75         75         105         75         75         105         75         105           135         90         90         105         90         90         105         90           75         50         105         75         105         75         105         105 | 45           75         105         120         75         90         90           120         75         135         75         75         90         9  | 45           75         105         120         76         90         90           120         75         105         105         75         75           90         90         105         105         105         105           75         163         90         105         105         105           75         163         90         105         105         105   |
| 46           75         75         76         105         150         137           75         70         100         105         75         100         100           90         120         90         120         75         20         100   | 46           Participant           75         75         105         150         135           75         120         105         75         105         90           90         120         90         120         75         120         90           90         90         75         90         105         90         105         90           105         135         75         75         75         90         90         105         90   | 47           75         105         105         105         105           75         90         90         75         105           90         75         105         105         105           100         75         105         105         105           90         75         105         105         105           120         90         75         105         105           100         105         105         105         105   | 47           75         105         120         135         75           75         90         75         105         100         101         101           90         75         135         90         75         105         105           100         75         135         90         100         105         105           120         90         75         105         105         105         105           75         90         105         75         75         90         105         105         105  | Harm         Harm           75         75         90         135         75         120           75         105         75         75         105         90           105         90         75         75         105         90           90         90         75         75         105         75           90         90         75         75         105         75  | H8         Solution         S | H9           105         75         105         90         105         90           75         90         105         90         105         90           90         75         105         90         105         105           100         75         105         105         105         105           100         90         105         105         105         105           100         90         105         105         105         100   | 49           105         75         90         90         105         90           75         90         105         90         105         90         105           90         75         150         75         130         75           100         90         105         125         75         120           100         75         100         126         75         120   | 50           75         150         75         120         105         75           90         90         75         90         90         75         105           90         105         105         75         90         120         105           90         105         105         75         90         120         105           105         135         120         75         90         120         120           75         75         135         90         75         90         120  | S0         75         120         76         120         75         75         75         75         90         75         105         75         90         75         105         90         75         105         90         75         105         90         75         105<  |
| S1         S2         100         75         25         100         75         100         100         75         100  | 51           75         150         76         75           75         105         76         75         120           105         90         105         75         90           75         90         105         75         90           76         90         105         90         75         90           105         90         105         90         75         90           105         90         105         90         75         90  | 52           105         75         105         136         90         120           75         75         90         165         75         120           90         75         75         120         75         120           90         75         75         120         75         120           90         75         75         120         75         120           90         75         75         120         75         120           90         75         75         120         75         120           90         75         75         120         75         120   | S2         S3         80         120           105         75         105         135         90         120           75         75         90         150         75         120           90         75         90         150         75         120           90         75         90         150         75         120           90         75         90         150         75         120           90         75         90         150         75         120  | S3         S4         S5         S6         S7         S7<                             | S3         S3           90         90         80         150         90           75         75         1505         75         120         90           90         135         800         105         90         150         151           75         75         1505         75         120         90         155         150         151   | 54         0  | 54           75         120         135         90         75         90           97         75         90         90         90         75           75         105         105         90         75         105           76         120         75         150         120         105           90         75         105         135         150         105  | Solution         Solution | Stress         Stre         Stre         Stre  |
| Solution  | S6         Toto         90         120         90         75           105         90         120         90         75           105         75         135         75         120           100         90         120         90         105           90         90         120         105         105           90         90         75         75         90         105  | 57           105         75         90         75         90           90         75         105         150         90           90         90         120         175         161         150           90         90         120         75         150         150         150           120         105         75         90         75         120         105         105         150         150  | S7         90         90           105         75         90         75         90           90         75         75         105         150           90         90         120         75         105         150           91         92         120         75         105         150           92         90         120         75         90         75           120         105         75         90         75           120         105         75         90         75  | 58         58           120         136         90         75         90         105           75         75         120         75         90         105         75           90         75         90         105         75         90         105         75           90         90         158         150         75         90         105         105         105           90         90         158         150         150         155         <                                      | 58           120         135         90         75         90         105           75         75         75         120         75         90           90         75         90         105         75         90           90         155         120         75         90           90         155         150         75         95           90         155         150         75         75  | 59           75         75         90         150         75           120         90         75         75         105         75           90         105         75         75         106         90           120         90         155         75         106         90           100         90         156         120         75         105           100         90         156         120         75         105   | 59           75         50         90         150         75           120         90         75         75         105         75           90         105         75         75         105         90           120         90         135         120         75         155           90         105         75         105         90         105           120         90         135         120         75         155  | 60           75         105         90         75         105         75           75         105         90         75         103         70         135           75         120         75         130         75         90         75           105         90         150         120         90         90         75           105         90         120         90         90         90         15  | 60         75         105         90         75         105         90         75         90         75         90         75         105         90         75         90         135         75         90         75         105         90         75         105         90         75         105         90         75         105         90         75         105         90         75         105         90         105         105         105         105         105         105         105         105         105         105         105         105         105         105         105         105   |
| 61           75         90         75         105         135         75           90         75         90         120         105         75           150         105         75         75         90         75           90         120         105         75         75         90         75           90         120         105         75         75         90         75   | 61           Participant           75         90         75         105         135         75           90         75         90         120         105         75           150         105         75         75         90         75           90         120         120         105         75           90         120         125         75         75   | 62           150         90         75         120         75         75           90         105         135         90         75         75           90         90         105         155         90         75         90           90         90         105         155         90         75         90         90         105         150         90   | 62           150         90         75         120         75         175           90         105         135         90         75         120         75           90         90         90         105         135         90         75         90           90         90         90         75         90         90         105         120           90         90         90         75         90         90         100         120   |  |   |   |  |   |   |

**Fig. S6.** Proportions of the demonstrator's choices in observational trials (left) and the participant's choices in independent trials (right) over the 30 options (Choice-only condition).

# Reward-only condition

Choice proportion

0.25 0.50 0.75 1.00

| 1           75         90         90         75         105         90           75         90         105         120         75         90           75         90         105         120         135         135           120         75         75         90         135         135           120         105         75         90         135         90  | Yarticipant           75         80         90         75         105         90           75         90         105         120         125         90         135           75         90         105         105         75         135         135           120         75         75         105         75         75         105         75  | 2           75         1.05         4.05         4.00         9.00         12.0           75         1.20         1.05         1.00         9.00         12.0           75         1.20         1.05         1.05         9.00         12.0           1.35         7.5         7.5         9.0         9.0           1.35         1.05         1.05         7.5         9.0           9.00         7.5         7.5         9.0         9.05  | 2           75         150         105         90         90         120           75         120         105         120         90         75           152         75         75         90         90         90           153         75         75         75         90         90           133         105         105         75         90         105           900         75         75         90         105   | 3           90         105         120         105         120         75           75         75         90         75         130         75           90         75         90         90         105         75           105         90         90         105         75         105           105         90         75         105         75         105   | 3           90         105         120         105         120         75           75         90         75         135         75           90         75         102         90         135         75           90         75         102         90         135         75           105         90         75         105         75         155           105         90         75         105         75         155   | 4           105         90         90         120         90         75           90         135         75         90         140         130         75           75         90         75         75         75         105         100         100           105         105         900         75         75         75         100 | 4           100         90         90         120         90         75           90         135         75         90         120         130           75         90         75         75         75         105           105         105         90         75         75         75         105           105         105         90         75         75         75         90         105           106         75         75         75         75         105         105   | 5         5           105         00         105         105         20           75         100         105         105         100           75         90         90         75         90         105           76         90         90         75         90         105           90         90         75         50         105         105   | 5           Participant           105         90         105         120         90           75         75         150         135         75         120           75         90         90         75         90         135         105           90         90         75         90         75         90         75   |   |
|---|--|--|--|---|---|---|--|--|--|---|
| 6           135         105         105         75         75         75           130         120         120         155         90         75           120         75         75         90         100         150           75         75         75         90         90         105           90         90         75         105         90         105  | 6           Participant           185         105         105         75         75           90         120         125         90         75           120         75         75         90         105         150           75         75         90         90         105         150           90         90         75         150         75         90   | 7         135         105         75         90         75           90         75         75         120         105         1-0           120         75         135         120         90         90           166         75         90         75         155         100         105           106         75         90         75         150         105         101   | 7         75         185         105         75         90         75           90         75         75         120         105         150           120         75         135         120         90         90           105         75         90         75         150         100           105         75         90         75         105         100           105         75         90         75         105         90  | 8         8           75         105         90         75         120         90           155         75         90         105         90         75           105         75         125         105         90         90           90         105         90         105         90         90           90         105         120         120         90         90   | 8         9         9         10         9         10         90         10         90         10         90         10         90         10         90         10         90         10         90         10         90         75         10         75         10         75         10         90   | 9           90         75         105         75         105           75         90         75         75         90         75           75         105         120         120         90         105           75         75         75         150         105         75           90         90         135         90         90         105  | 9         Participant           90         75         105         75         105         120           90         75         105         75         105         120           75         90         75         75         90         75           75         135         120         120         90         105           76         75         75         150         105         75           90         90         135         90         90         105  | 10           90         75         105         90         75         90           150         105         75         105         90         105           120         90         75         75         105         105           75         120         105         120         75         90           75         150         105         120         75         90   | 10         20         75         10.5         90         75         90         90           90         75         10.5         80.8         75         90         90           120         90         75         10.5         10.5         10.5         10.5         10.5           75         120         10.5         120         7.5         90         90           75         75         10.5         10.5         10.5         10.5         10.5   |   |
| 11           Demonstrator           75         120         75         105         75           90         75         75         105         90           135         75         90         120         75         75           120         90         90         155         150         90           75         105         90         105         150         90           75         105         90         105         150         90   | 11           Participant           75         105         75           90         75         105         90           135         75         105         105         105           120         90         105         105         90           135         75         90         105         105         90           105         90         90         105         105         90           75         105         90         105         105         90  | 12           Demonstrator           90         90         135         90         105           75         75         135         75         90         155           75         75         120         75         90         105           105         120         75         150         75           105         75         75         120         90         90   | 12           Participant           9         90         90         135         90         105           75         75         135         75         90         105           75         75         120         75         90         105           105         120         105         75         105         105           105         75         75         120         90         90   | 13           Demonstrator           90         105         150         75         75           120         75         90         120         90         75           75         75         75         75         105         90           120         90         135         90         105         75           75         75         75         75         105         90           120         90         135         90         105         75  | 13           Participant           90         105         150         75           120         75         90         120         90         75           120         75         90         120         90         135           120         90         135         90         105         75           120         90         135         90         105         75           100         90         135         90         105         75  | 14           Demonstratori           75         105         120         75         90           75         90         135         90         75         120           105         135         75         120         105         105           105         90         75         120         105         105           00         90         75         120         105         105   | 14           Participant           75         105         120         75         90           75         90         135         90         75         120           105         155         75         120         155         75         150           106         90         75         75         75         150           108         90         75         75         75         150  | 15         105 <th105< th=""> <th105< th=""> <th105< th=""></th105<></th105<></th105<> | Second |   |
| 16           Demonstratori           120         75         90         90         75           120         75         150         105         105         75           120         75         150         105         105         75           130         75         150         105         105         105           135         90         135         90         75         105           75         75         75         90         75         105   | 16           Participant           120         75         90         90         75           120         75         190         105         105         75           75         105         120         90         105         90         105           136         90         138         90         155         105         105           75         75         75         75         90         90         105         90   | 17         75           120         105         75         75         105           90         105         75         75         90         150           135         90         155         90         150         150           136         90         155         90         150         150           136         75         75         90         150         150           136         75         75         75         75         90  | 17           20         105         75         75         105         75           90         105         75         75         105         75           120         105         75         90         150         150           120         75         90         105         90         105           120         75         90         90         105         100           135         75         75         75         75         100         105   | 18           Demonstratori           75         75         135         105           90         135         75         90         150         90           120         120         105         75         90         90         90           90         75         90         90         75         105         105           90         75         90         90         75         105         105  | 18         18           75         75         135         105         105           90         135         75         135         106         105           120         120         105         75         90         90         90           90         75         90         90         75         100         105           75         120         75         90         90         75         100   | 19           Demonstratori           75         105         120         90         135           105         120         90         150         90         75           75         75         90         75         75         90         75           90         75         105         75         75         90         90         105           90         90         120         105         135         90         90         90         100                 | 19           Participant           75         105         105         20         90         135           105         120         90         150         90         75           75         75         90         75         75         75           90         75         105         75         75           90         90         120         105         135   | 20           Demonstrator           0         75         75         90         150         90           75         90         90         135         120         75           105         75         90         135         150         75           75         75         76         90         135         157           102         75         100         150         150  | Your         Your <th< td=""></th<>  |   |
| 21           75         90         125         90         75         105           120         75         90         75         105         105           75         90         75         120         105         90           75         90         75         120         105         90           75         90         75         120         105         90           105         100         150         105         90         90   | 21           Participant           75         90         75         90         75         105           120         75         90         75         105         90         75         105           75         90         75         120         105         90         75         105           75         90         120         75         75         105         105           105         150         135         105         90         90         100         105  | 22           Demonstrator           105         60         105         75         90         90           120         105         75         135         90         75           75         120         75         135         75         150           75         75         75         75         120         105           90         150         90         75         90         90   | 22           Participant           105         90         105         75         90         90           120         105         75         135         90         75           75         120         75         135         90         75           75         75         75         120         105           90         150         90         75         120         105  | 23           Derror         ST 400         75         120         105           90         75         105         90         105         75           75         75         75         90         120         105           135         75         90         135         90         155           90         75         150         75         90         135  | 23           Participant           10         75         100         75         100           90         75         105         90         105         75           75         75         75         90         105         105           103         75         90         105         90         105           90         75         100         105         90         105   | 24           Develoant         101         105         120         90           75         120         75         75         90         75           75         75         705         75         90         75           75         75         75         75         90         75           75         75         75         75         90         75           105         75         75         75         90         75  | 24           Participant           10         04         10         10         10           120         75         75         90         90           105         75         105         75         90         150           105         75         75         90         150         150           105         105         105         105         90         160   | 25         25           90         75         105         90         75         105           106         90         120         90         120         90         120           102         75         153         155         155         155         155         155           103         75         150         90         90         155         155           103         75         150         90         90         155         155  | Yes         Yes         Yes           90         75         105         90         75         105           105         90         120         90         120         75           106         75         150         90         90         75           108         75         150         90         90         105           108         75         150         90         90         105   |   |
| 26           DUDINGRATION           90         75         120         90         90           105         75         105         75         50         105           75         135         90         105         105         105           90         135         75         136         90         105           90         135         75         120         90           75         90         75         105         90  | 26           90         75         120         90         90           165         75         105         75         150           75         135         90         105         105           90         185         75         75         120           90         185         75         150         90   | 27           120         135         90         135         75           90         90         135         90         105           75         75         100         100         100           90         90         75         90         75         100           90         90         150         75         90         105           75         105         150         75         90         105  | 27           120         135         90         135         75           90         90         75         90         75           75         75         105         120         75           90         90         75         90         75           75         75         105         120         75           90         90         150         75         90   | 28           75         105         75         150         130         120           75         105         75         105         75         105           90         90         75         76         90         120           90         90         75         75         90         75           90         120         90         75         75         90   | 28           Participant           75         105         75         100         75           75         105         105         105         105         105           90         90         75         75         90         120           90         75         75         90         75         90           90         75         75         90         75         90   | 29           90         75         90         120         150         90           105         75         105         90         105         75           105         75         105         90         105         75           105         75         75         135         75           105         75         75         75         135           105         75         75         75         105   | 29           90         75         90         120         150         90           105         75         105         90         105         75           105         75         120         90         135         135           105         75         75         75         135         135           105         75         75         75         135         135           105         75         90         75         130         90  | 30           75         120         135         75         161           75         75         105         90         90           90         120         75         105         105           75         75         105         90         90           90         120         75         105         105           90         75         75         105         90   | S0           Participant           75         120         135         75         105           75         105         105         90         90           90         120         75         105         105         102           76         75         75         105         105         120           90         120         75         105         105         120           76         75         75         105         105         120           90         120         75         105         105         120  |   |
| 31           75         105         105         75         90           75         75         90         90         105         90           135         120         75         150         90         100         90           135         75         150         90         105         90         100           136         75         150         90         105         90         100   | 31           75         105         105         75         75         90           75         75         90         90         105         90           133         120         75         150         90         120           135         75         150         90         105         90           75         75         90         90         105         90           136         120         75         100         90         105         90           136         75         150         90         105         90         120         100         100  | 32           90         75         103         75         100           75         75         90         75         105         90           90         105         75         105         75         90           90         105         75         105         90         15           100         105         75         105         90         15           100         105         75         105         90         15           100         105         75         100         90         15           100         105         75         100         90         15           100         105         75         100         90         15           100         105         75         90         90         15           100         105         75         90         90         15  | 32           90         75         120         105         75         120           75         75         00         75         105         90           90         105         75         105         90         75         126           90         105         75         105         90         75         126           90         105         75         100         75         135           75         75         75         90         150         135  | 33           90         75         75         105         90         120           75         75         90         90         75         75         90         120         125           75         90         120         123         125         155         150           90         120         123         125         155         150         150           90         90         75         90         75         150         150         150   | 33           90         75         75         105         90         120           75         75         105         90         75         75           75         90         120         135         150         90         120           75         90         120         135         150         90         150         90           90         90         75         90         120         135         150         90   | 34           90         120         135         90         150         90           90         90         75         75         105         90           75         120         75         75         105         90           75         75         105         90         75         151           120         155         105         90         75         155  | 34           90         120         130         90         150         90           90         97         75         75         105         90           75         120         75         75         105         90           75         120         75         75         105         90           75         120         75         75         105         90           75         100         90         97         75         105   | 35         90         120         75         90         75           135         90         120         75         90         75           105         150         90         75         105         90           105         150         90         75         105         90           75         75         120         135         90         105           75         150         90         75         105         90         105  | 35         90         120         75         90         75           135         90         120         75         90         75           135         90         90         75         105         90         75         105           135         150         90         75         105         90         105   |   |
| 36           105 75 120 75 90 90           105 75 120 75 90 75 120           120 90 75 90 75 75 90           90 105 150 75 75 90           90 105 150 75 75 90  | 36           Participant           105         75         105         105         105           108         15         105         105         120           109         75         90         75         120           120         90         75         90         75         120           120         90         15         150         75         75           90         105         150         75         75         75  | 37           75         75         75         75         75         90           00         155         120         75         105           00         90         105         90         150         105           90         90         105         90         150         105           90         90         105         90         150         105           90         90         105         90         150         105           90         90         105         90         150         105           90         75         150         105         120         75   | 37           75         75         76         75         75         76         75         90           90         103         120         75         150         105           90         90         105         90         90         105         100           90         75         135         105         100         155           105         90         75         155         100         90  | 38           Dermonstruter           120         75         100         76         90           75         75         90         90         150           75         75         120         90         75         130           75         75         120         90         75         130           75         75         120         90         75         130           75         75         100         90         90         75           105         75         105         105         120         130     | 38           Participation         120         75         100         76         75         90           75         75         120         90         90         105         150           75         75         120         90         75         135           75         75         120         90         75         135           76         75         100         90         90         155           105         75         105         105         105         135   | 39           Dermonstrator           90         150         75         105         120         105           75         90         90         105         75         90         90         105           75         90         90         105         75         105         105           75         90         90         105         75         105         105           75         75         120         135         90         75         105           76         75         120         135         75         120         135         75  | 39           90         150         75         105         120         105           75         90         90         105         75         105         105           75         90         90         105         75         105         105         105           76         90         90         105         75         105         105         105           76         75         120         135         75         105         105         105           76         75         120         135         75         105         105         105 | 40           IOS 120 90 90 90           75 75 90 75 120 75           150 90 75 90 105 105           150 90 75 90 105 105           150 97 75 90 105 105           160 75 105 90 75   | Harticipartitantet andetet andetet andetet andetet andetet andetet andetet ande            |   |
| 41           120         75         100         90         105         75           131         105         90         135         152         120           75         75         90         125         125         120           105         90         75         120         75         120           90         90         150         75         90         75   | 41           Participant           120         75         105         90         105         75           135         105         90         135         115         120           75         75         90         75         75         90           106         90         75         120         75         90           105         90         75         120         75         90   | 42           75         75         75         120         120           90         75         90         90         90         91           105         105         105         90         90         105           75         150         105         90         90         105           75         150         105         90         75         135           75         90         75         120         75         135  | 42           75         75         75         120           07         75         75         120           105         105         90         90         125           105         105         105         90         90         135           75         150         105         90         75         135           75         90         75         120         75         135  | BO BOO TAS 150 POO           90         90         75         150         90           75         90         75         90         120         75           105         75         75         90         120         75           105         75         75         90         120         75           105         75         75         90         120         75           105         75         150         150         150         120           90         75         105         150         90         120 | Harticipante           90         90         75         150         75         90           75         90         75         90         120         75           105         75         75         75         90         120         75           105         75         75         75         75         75         120         90           105         125         105         150         75         120         90         90         75         105         120         120         120   | 44           00         75         90         120         120         75           105         120         75         75         155         75           135         105         90         75         90         105           90         105         75         75         15         90           150         75         90         75         90         105   | 44           90         75         90         120         120         75           105         120         75         75         135         75           138         105         90         75         90         105           90         105         75         75         75         90           100         105         75         75         75         90  | 45           180         90         90         120         75           105         75         75         75         120           106         75         75         90         75           105         75         75         90         90           106         120         75         75         90           106         120         75         75         90         90  | 45           Participant         100         70         75           105         75         75         150         120           105         75         75         150         120           90         75         75         150         120           90         75         75         90         90           90         90         155         75         90         90           90         90         155         105         105         105  |   |
| Home         Home <td>46           Participanti           105         90         120         90         90         75           105         135         75         105         75         105           105         120         75         90         120         75           75         75         90         150         75         105           75         90         150         75         90         105</td> <td>Home         Home         Home<td>47           75         80         105         75         80         120           90         75         150         75         80         120           75         75         105         90         135         90           75         106         75         90         105         90           75         106         75         90         105         90</td><td>H8         H8           135         75         90         120         75           135         75         90         120         75         100           135         75         105         90         120         100           75         75         90         105         90         120           90         120         90         75         90         120</td><td>H8         Variable         V</td><td>H9         H9           120         00         00         135         75           75         75         90         75         120         105           90         105         75         105         105         101           100         105         75         105         105         101           100         105         75         105         105         101</td><td>49           Participant           120         90         90         135         75           75         90         75         75         105           90         105         75         100         100           100         105         75         105         100           100         105         75         105         100           100         105         75         105         100</td><td>50           75         90         90         120         90           75         185         105         90         105           75         180         100         100         105           75         180         100         100         105           90         185         75         90         105           90         185         75         90         105</td><td>Solution         Solution         Solution</td></td>  | 46           Participanti           105         90         120         90         90         75           105         135         75         105         75         105           105         120         75         90         120         75           75         75         90         150         75         105           75         90         150         75         90         105   | Home         Home <td>47           75         80         105         75         80         120           90         75         150         75         80         120           75         75         105         90         135         90           75         106         75         90         105         90           75         106         75         90         105         90</td> <td>H8         H8           135         75         90         120         75           135         75         90         120         75         100           135         75         105         90         120         100           75         75         90         105         90         120           90         120         90         75         90         120</td> <td>H8         Variable         V</td> <td>H9         H9           120         00         00         135         75           75         75         90         75         120         105           90         105         75         105         105         101           100         105         75         105         105         101           100         105         75         105         105         101</td> <td>49           Participant           120         90         90         135         75           75         90         75         75         105           90         105         75         100         100           100         105         75         105         100           100         105         75         105         100           100         105         75         105         100</td> <td>50           75         90         90         120         90           75         185         105         90         105           75         180         100         100         105           75         180         100         100         105           90         185         75         90         105           90         185         75         90         105</td> <td>Solution         Solution         Solution</td> | 47           75         80         105         75         80         120           90         75         150         75         80         120           75         75         105         90         135         90           75         106         75         90         105         90           75         106         75         90         105         90   | H8         H8           135         75         90         120         75           135         75         90         120         75         100           135         75         105         90         120         100           75         75         90         105         90         120           90         120         90         75         90         120   | H8         Variable         V   | H9         H9           120         00         00         135         75           75         75         90         75         120         105           90         105         75         105         105         101           100         105         75         105         105         101           100         105         75         105         105         101  | 49           Participant           120         90         90         135         75           75         90         75         75         105           90         105         75         100         100           100         105         75         105         100           100         105         75         105         100           100         105         75         105         100   | 50           75         90         90         120         90           75         185         105         90         105           75         180         100         100         105           75         180         100         100         105           90         185         75         90         105           90         185         75         90         105   | Solution  |   |
| S1         S2         S3         S3 <ths3< th="">         S3         S3         S3<!--</td--><td>SI         SI         SI&lt;</td><td>S2         S3         76         70          70          <th 70<<="" td=""><td>52         53         120         105         75           90         90         150         135         120         75           75         75         75         90         90         90           75         156         155         75         105         105           75         90         75         75         90         90         90</td><td>Same         Same         <th< td=""><td>53           Participant           10         135         150         90         75           75         105         90         25         91           90         90         135         90         25         105           105         90         90         75         90         26         27           105         90         90         75         90         26         27           105         90         90         155         90         26         27</td><td>54           105         75         90         75         90           120         120         75         90         90         90           75         75         75         105         75         90         90           75         75         135         90         105         90         105           100         100         105         105         150         136         100</td><td>54           105         75         75         90         90         90           120         120         75         90         90         90         90           75         75         75         105         75         90         105         90           75         75         155         90         105         90         105         90           120         100         105         105         105         105         105         105</td><td>55           90         105         120         76         13           150         75         105         76         105         10           90         135         120         76         105         10           90         135         120         75         75         105           90         120         75         75         90         125           90         105         90         75         90         25</td><td>State         State         <th< td=""></th<></td></th<></td></th></td></ths3<> | SI         SI< | S2         S3         76         70          70 <th 70<<="" td=""><td>52         53         120         105         75           90         90         150         135         120         75           75         75         75         90         90         90           75         156         155         75         105         105           75         90         75         75         90         90         90</td><td>Same         Same         <th< td=""><td>53           Participant           10         135         150         90         75           75         105         90         25         91           90         90         135         90         25         105           105         90         90         75         90         26         27           105         90         90         75         90         26         27           105         90         90         155         90         26         27</td><td>54           105         75         90         75         90           120         120         75         90         90         90           75         75         75         105         75         90         90           75         75         135         90         105         90         105           100         100         105         105         150         136         100</td><td>54           105         75         75         90         90         90           120         120         75         90         90         90         90           75         75         75         105         75         90         105         90           75         75         155         90         105         90         105         90           120         100         105         105         105         105         105         105</td><td>55           90         105         120         76         13           150         75         105         76         105         10           90         135         120         76         105         10           90         135         120         75         75         105           90         120         75         75         90         125           90         105         90         75         90         25</td><td>State         State         <th< td=""></th<></td></th<></td></th>   | <td>52         53         120         105         75           90         90         150         135         120         75           75         75         75         90         90         90           75         156         155         75         105         105           75         90         75         75         90         90         90</td> <td>Same         Same         <th< td=""><td>53           Participant           10         135         150         90         75           75         105         90         25         91           90         90         135         90         25         105           105         90         90         75         90         26         27           105         90         90         75         90         26         27           105         90         90         155         90         26         27</td><td>54           105         75         90         75         90           120         120         75         90         90         90           75         75         75         105         75         90         90           75         75         135         90         105         90         105           100         100         105         105         150         136         100</td><td>54           105         75         75         90         90         90           120         120         75         90         90         90         90           75         75         75         105         75         90         105         90           75         75         155         90         105         90         105         90           120         100         105         105         105         105         105         105</td><td>55           90         105         120         76         13           150         75         105         76         105         10           90         135         120         76         105         10           90         135         120         75         75         105           90         120         75         75         90         125           90         105         90         75         90         25</td><td>State         State         <th< td=""></th<></td></th<></td> | 52         53         120         105         75           90         90         150         135         120         75           75         75         75         90         90         90           75         156         155         75         105         105           75         90         75         75         90         90         90  | Same         Same <th< td=""><td>53           Participant           10         135         150         90         75           75         105         90         25         91           90         90         135         90         25         105           105         90         90         75         90         26         27           105         90         90         75         90         26         27           105         90         90         155         90         26         27</td><td>54           105         75         90         75         90           120         120         75         90         90         90           75         75         75         105         75         90         90           75         75         135         90         105         90         105           100         100         105         105         150         136         100</td><td>54           105         75         75         90         90         90           120         120         75         90         90         90         90           75         75         75         105         75         90         105         90           75         75         155         90         105         90         105         90           120         100         105         105         105         105         105         105</td><td>55           90         105         120         76         13           150         75         105         76         105         10           90         135         120         76         105         10           90         135         120         75         75         105           90         120         75         75         90         125           90         105         90         75         90         25</td><td>State         State         <th< td=""></th<></td></th<> | 53           Participant           10         135         150         90         75           75         105         90         25         91           90         90         135         90         25         105           105         90         90         75         90         26         27           105         90         90         75         90         26         27           105         90         90         155         90         26         27  | 54           105         75         90         75         90           120         120         75         90         90         90           75         75         75         105         75         90         90           75         75         135         90         105         90         105           100         100         105         105         150         136         100   | 54           105         75         75         90         90         90           120         120         75         90         90         90         90           75         75         75         105         75         90         105         90           75         75         155         90         105         90         105         90           120         100         105         105         105         105         105         105  | 55           90         105         120         76         13           150         75         105         76         105         10           90         135         120         76         105         10           90         135         120         75         75         105           90         120         75         75         90         125           90         105         90         75         90         25  | State         State <th< td=""></th<> |
| 56           Dernorskrater           120         135         75         175         175         175           90         90         75         105         135         105           105         90         75         120         120         75           90         75         90         90         90         90           75         105         150         150         150  | 56           Participant           120         138         75         75         75           90         90         75         105         105         105           106         90         75         102         120         75           90         75         90         90         90         90           75         75         105         150         150         150  | SF JUNCE           75         90         90         150         120           75         105         105         105         90           90         75         105         75         90           90         75         105         75         105           90         75         105         75         105           90         75         75         105         90  | 57           Participant           75         90         90         150         135         120           75         105         105         105         90           90         75         105         105         105           90         75         105         105         105           90         75         105         105         105           90         75         120         75         135         105   | 58         58           75         105         90         106         90           75         75         103         90         105         90           90         75         75         135         90         105           76         100         90         105         150         105           75         75         135         90         105         106   | 58         90         100         90         90         90         90         90         90         90         90         90         90         90         90         97         75         100         90         75         90         90         90         105         100         90         105         100         90         105         100         90         105         100         90         105         100         100         90         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         105         100         100         105         100         105         100         105         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100   | 59<br>Demonstrator           75         75         105         105         105           75         90         90         75         75         90         90           120         90         90         75         105         105         105           90         75         75         100         105         105         105           100         75         90         90         105         105         105           101         75         75         90         90         105         105  | 59           75         72         105         105         105           76         90         75         75         50         90           120         90         90         75         105         95           90         75         135         75         90         105           120         97         75         90         90         126   | 60           75         105         106         90         75         105           120         157         105         90         75         105           75         90         150         75         90         105           135         105         120         75         90         100           75         90         90         75         90         100   | 60           Participation           75         105         105         90         75         75           120         135         105         90         150         75         90           135         105         120         75         90         150         75         90           135         105         120         75         90         120         120  |   |
| 61           90         135         90         120         75         90           105         105         75         75         75         135           100         102         75         105         90           120         75         105         90         90  | 61           90         135         90         120         75         90           105         105         75         75         155         135           150         90         75         75         105         90           120         75         105         90         90         120         75         90           120         75         105         90         90         90         75         155         90         90   | 62           90         60         120         105         75         150           120         105         105         90         75         75           75         90         75         75         90         75           105         105         105         100         75         75           105         105         105         100         75         90         75           105  | 62           90         90         120         105         75         150           120         105         105         90         75         75           75         90         75         75         90         75           105         105         135         135         90         75           105         15         155         90         90         90         90         90         100   |   |   |   |  |  |  |   |

**Fig. S7.** Proportions of the demonstrator's choices in observational trials (left) and the participant's choices in independent trials (right) over the 30 options (Reward-only condition).

## Choice+Reward condition

Choice proportion

0.25 0.50 0.75 1.00

| 1           75         75         90         150         75         105           75         75         90         75         75         105           75         90         150         90         150         120           120         105         105         105         105           90         90         90         75         105  | Participant           75         75         90         150         75         105           75         75         90         75         75         105           75         90         150         90         150         120           120         105         105         105         120           120         105         105         105         105           90         90         90         75         90         75   | 2           90         75         135         75         90         120           75         120         75         150         90         90         90           75         120         75         120         15         57         90         120           75         100         75         100         100         75         57           75         100         75         100         105         75           75         100         75         100         105         75  | 2           90         75         135         75         90         120           75         120         75         150         90         90           75         100         120         75         150         90         90           75         90         75         100         105         75         75         90         75         120         75           75         90         75         105         105         75         75         90         75         105         105         75           75         105         90         75         90         75         105         105         75 | 3           105         80         120         75         76         75           105         135         75         120         105         75           120         70         75         90         100         150           120         75         90         90         150           120         75         90         150         150           120         75         90         90         75           90         90         75         90         100  | 3           Participal           105         900         120         75         75           105         153         75         120         105         15           120         75         900         75         900         150           75         90         90         90         90         92           90         90         75         105         105  | 4           75         75         105         75         106         75           90         90         90         75         90         135           105         120         156         100         75           100         150         90         150         90         75           101         120         156         157         90         75           100         75         105         75         90         120  | 4           75         75         105         75         105           90         90         90         75         90         185           105         120         90         150         90         75           75         120         90         150         90         75           75         120         105         150         75           90         75         105         75         90  | 50         50         50         50         60           105         90         105         75         105         90           105         90         102         120         75         75           90         105         27         75         90         105           90         90         75         75         90         105           90         105         90         150         75         95   | Solution  |
|--|---|--|---|--|--|--|---|---|--|
| 6           195 90 120 105 90 90           195 120 90 90 90         120 75           195 120 75         75 75         75 90           196 75 75 105 75         75 75           106 90 75 90 75         90 75   | 6           135         90         120         105         90           135         90         120         120         150           135         75         75         75         105           105         90         90         90         120         75           105         105         75         105         75         105           106         90         75         90         75         105         75  | 7         120         90         120         90         75           120         75         105         75         135         135           75         75         105         75         135         135           90         90         75         105         75         135           90         90         75         105         75         15           120         105         75         105         90         105   | 7         75         90         150         120         90         75           120         75         105         75         105         75         135           75         75         105         75         105         75         135           90         90         75         105         75         125         125           120         105         75         105         90         105         75   | 8         7         105         75         107         75         90         75           105         155         90         120         75         90         135         150           105         155         90         125         90         135         150           105         75         90         125         75         90         105           75         75         105         75         90         125         105   | 8         7         120         7.5         9.0         7.5           105         75         120         7.5         9.0         9.0           105         125         9.0         120         9.0         9.0           90         120         7.5         9.0         130         9.0           90         120         7.5         9.0         135         150           105         7.5         9.0         7.5         9.0         105           7.5         105         7.5         9.0         105         105   | 9           00         75         75         105         76           100         75         75         90         120         135           90         75         75         90         120         135           90         75         150         120         135           90         75         150         120         135           90         75         150         120         135   | 9         9           90         75         75         90         75         90           100         75         75         90         120         135           90         75         75         90         120         135           90         75         105         120         135           90         75         75         90         105         75           90         75         105         120         105         75  | 10         90         105         90           120         105         75         90         105         90           75         75         76         75         75         75           135         90         90         90         105         75           75         75         90         120         75         90           135         75         100         120         75         90   | 10           Participant           120         05         75         90         105         90           75         75         150         75         75         75           75         75         90         90         105         75           75         75         90         120         75         90           135         75         105         90         105         120  |
| 11           00         75         120         105         75           105         135         75         105         90         75           105         135         105         105         90         75           106         135         105         105         90         75           100         155         100         75         100         75           100         75         120         90         75         120  | 11           Participant           75         90         75         120         105         75           90         135         75         75         105         75           90         90         90         75         90         75           90         90         90         75         90         75           120         75         120         80         75         150   | 12           00         105         75         120         75         90           75         75         90         135         75         75           153         75         75         120         75         150           90         90         105         75         150         150           90         90         90         105         75         150           90         90         90         105         75         150           120         75         135         90         90         75  | 12           Participant           90         105         75         120         75           75         75         90         135         75           150         75         75         120         105         105           90         90         90         105         75         105           90         90         90         105         75         105           90         90         90         90         90         75         105           100         75         135         90         90         75         105   | 13           Demonstrator           90         105         120         75         120         75           90         105         90         75         90         120           150         80         80         90         75         75           105         75         75         90         135           105         75         75         5         90         135  | 13           Participant           90         105         120         75           90         105         90         75         90         120           150         90         90         90         95         75           105         75         75         75         90         135           105         75         75         135         75         105   | 14           100         75         135         105         90         105           90         90         135         120         75         75           90         75         75         75         105         75           75         75         90         105         120         75           75         75         90         105         120         75           75         90         105         120         75         90  | 14           Participant           100         75         105         00         105           00         105         120         75         15           00         75         75         105         15           75         75         90         105         120           75         75         90         105         150           75         90         105         120         75  | 15           135         105         120         00         00         00           135         105         75         75         120         105           105         105         105         75         75         120         105           105         105         105         75         120         105           105         105         105         90         75         105           100         105         105         90         75         105  | Isaa         Isaa <thisaa< th="">         Isaa         Isaa         <thi< td=""></thi<></thisaa<>   |
| 16           Demonstratori           105         105         75         120         90           90         75         105         135         90         75           106         75         75         75         90         75           90         190         120         105         75         90           90         75         75         75         90         90           90         190         120         105         75         90           90         75         90         75         120         90   | 16           Participant           105         155         120         90           90         75         105         75         90         75           106         75         105         75         90         75           90         190         120         105         75         90           90         190         120         105         75         90           90         75         90         75         100         100  | 17           120         90         75         105         75           150         105         75         150           150         105         75         75         120           120         105         90         135         90         135           75         75         90         90         105         90           75         75         75         90         90         105   | 17           Participant           120         90         75         105         105           75         105         105         75         150           105         105         75         75         120           105         105         90         135         90           75         75         75         90         90         105   | 18         0         18         0         90         90         90         90         90         90         135         75         150         90         90         100         105         75         100         90         100         105         75         90         105         75         90         105         75         90         105         75         90         105         100 | 18         9           105         90         75         120         90         90           90         135         75         150         90         75           105         75         90         155         75         90           75         105         75         105         150         90           90         125         75         105         150         90           90         120         75         105         150         100   | 19           Derrorstrator           90         75         75         90         75           90         75         75         90         105           75         120         90         105         105           105         75         100         105         105           105         75         90         75         105  | 19           Participant           90         75         75         90         75         75           90         75         75         120         90         135           76         120         75         90         105         105           105         75         100         120         105         100           105         75         50         75         105         105   | Yold         Yold <thyold< th="">         Yold         Yold         <thy< td=""><td>20           Participant           75         100         75         90         105           75         90         105         90         120         75           90         150         90         105         75         75           75         135         90         75         135           105         75         120         90         135</td></thy<></thyold<> | 20           Participant           75         100         75         90         105           75         90         105         90         120         75           90         150         90         105         75         75           75         135         90         75         135           105         75         120         90         135   |
| 21           Demosstrator           105         75         105         105         90         90           75         135         120         75         75         105           75         75         90         75         75         120           136         90         105         75         75         120           136         90         105         75         75         120           75         90         150         90         90         90  | 21           Participant           105         75         105         90           75         105         105         90           75         50         105         75         105           106         75         105         75         105           105         90         105         75         101           105         90         105         75         101   | Yame         Yame <thyame< th="">         Yame         Yame         <thy< td=""><td>195         75         75         75         90         105           105         120         150         75         90         155           105         120         90         135         120         105           105         100         90         135         120         105           105         100         90         135         120         105           105         100         90         135         120         105</td><td>23           Demonstrator           150         135         135         120         105           106         105         90         90         75         150           120         120         75         90         90         75         75           90         90         75         75         75         75         90         90         75         75</td><td>23           Participant           150         135         120         105           150         156         90         90         75         75           120         120         75         90         90         75         75           90         90         75         75         75         90         90         75         75           90         105         75         100         75         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75</td><td>24           Deterministication           105         105         90         105         75           105         75         75         90         105         75           106         107         75         75         105         90         105         90           107         75         75         155         105         90         105         100           90         105         75         90         105         100         100</td><td>24           Participant           105         105         70         90         105         75           150         75         75         90         105         90           76         90         75         75         120         120           90         75         75         135         120         120           90         105         75         90         120         90</td><td>25           75         120         75         105         135           75         106         75         90         90         90           90         90         120         105         105         105           75         75         120         105         105         105           75         75         120         105         105         105           75         75         120         105         105         105</td><td>Yold         Yold         <thyold< th="">         Yold         Yold         <thy< td=""></thy<></thyold<></td></thy<></thyame<> | 195         75         75         75         90         105           105         120         150         75         90         155           105         120         90         135         120         105           105         100         90         135         120         105           105         100         90         135         120         105           105         100         90         135         120         105   | 23           Demonstrator           150         135         135         120         105           106         105         90         90         75         150           120         120         75         90         90         75         75           90         90         75         75         75         75         90         90         75         75  | 23           Participant           150         135         120         105           150         156         90         90         75         75           120         120         75         90         90         75         75           90         90         75         75         75         90         90         75         75           90         105         75         100         75         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75         75         75         90         90         75  | 24           Deterministication           105         105         90         105         75           105         75         75         90         105         75           106         107         75         75         105         90         105         90           107         75         75         155         105         90         105         100           90         105         75         90         105         100         100  | 24           Participant           105         105         70         90         105         75           150         75         75         90         105         90           76         90         75         75         120         120           90         75         75         135         120         120           90         105         75         90         120         90  | 25           75         120         75         105         135           75         106         75         90         90         90           90         90         120         105         105         105           75         75         120         105         105         105           75         75         120         105         105         105           75         75         120         105         105         105   | Yold         Yold <thyold< th="">         Yold         Yold         <thy< td=""></thy<></thyold<>   |
| 120         720         75         105         75         90           90         90         150         75         90         120         90         105         75         105         < | 26           120         75         105         70           90         90         150         75         90           90         75         75         75         105           135         90         155         75         105           90         75         75         75         105           136         90         155         75         105  | 27           105         75         100         90         105         90           90         75         75         105         105         75           105         120         120         75         155         155           105         120         120         75         75         105           105         120         120         75         75         105           105         120         120         75         75         105   | 27           Participanti           105         75         150         90         105         90           107         75         150         105         105         105           105         120         120         75         150         105         105           105         120         120         75         150         105         105           106         90         130         80         90         105         105  | 28           105         75         90         105         75           75         75         90         75         90           75         75         105         135         120           90         75         105         130         120           90         75         105         90         150         120           90         75         105         90         150         120   | 28           Darticipant           105         75         90         105         75           175         75         90         155         90           175         75         105         135         120         90           100         75         105         136         120         90           100         175         105         90         150         120           100         175         105         90         150         120           100         155         90         105         100         120  | York         York <th< td=""><td>29           75         75         90         75         120         75           90         75         105         105         120         90           75         135         90         105         75         90           75         135         90         105         75         90           75         135         90         105         75         90           135         105         120         105         90         75</td><td>Solution         Solution         Solution</td><td>Solution         Solution         Solution</td></th<> | 29           75         75         90         75         120         75           90         75         105         105         120         90           75         135         90         105         75         90           75         135         90         105         75         90           75         135         90         105         75         90           135         105         120         105         90         75  | Solution   | Solution  |
| 31           90         90         105         120         120         150           75         90         90         75         105         90           75         120         123         75         135         90           75         90         90         105         75         75           105         75         75         105         75         75  | 31           90         90         120         120         120           75         90         75         105         90           75         120         125         135         90           75         90         90         105         75         105           106         75         75         105         75         105   | 32           75         75         75         90         75           75         90         150         90         75           120         75         160         90         75           100         75         75         160         90         75           100         105         90         75         105         105           105         105         105         90         75         105   | 32           75         75         75         90         75           75         90         75         150         90         75           120         75         150         90         75         100           120         75         75         163         90         75           105         120         75         163         90         75           105         100         105         90         75         105  | 33           135         75         105         105         105           105         105         105         105         105         105           105         105         105         105         105         105         105           109         400         75         120         120         101         115           75         120         120         90         90         125         125           75         120         120         90         90         125         125   | 33           193         75         75         105         75           195         105         75         105         90           190         90         75         120         75         105           75         120         120         90         93         135           75         120         120         90         93         135   | 34           90         75         90         75         120           75         90         75         120         150           75         90         135         75         90         135           76         90         75         120         135         135           75         90         75         120         75         105           75         90         75         120         75         105   | 34           90         75         90         75         120         150           75         90         135         75         90         135           75         90         135         75         90         135           75         90         75         120         75         105           75         90         75         120         75         105           75         90         75         120         75         105  | 35         Jost State           75         135         75         105         90           120         75         135         75         105         90           105         120         75         120         75         90           105         120         75         120         75         90           90         90         75         105         75         90  | Second |
| 36           135         75         100         90         90           136         75         75         75         90           137         75         75         100         100           138         90         75         105         75         90           138         90         75         105         105         105           139         90         75         105         105         105  | 36           136         75         105         90         90         90           120         75         75         90         75         105         75           138         90         75         105         75         90         90           90         120         75         75         105         105         75           90         120         75         105         75         105         105   | 37           75         120         138         75         90           75         150         75         75         90           75         105         75         75         90           90         90         75         75         105         90           120         108         75         75         105         90           120         108         90         105         90         125  | 37           75         120         138         75         75         90           75         150         75         75         90         135           90         90         75         75         100         90           120         108         75         75         90         135           90         90         75         75         105         90           120         105         90         105         90         120   | 38           90         90         75         90         75           75         90         75         90         105           75         105         90         75         90           75         105         105         120         105           75         105         105         150         151           100         105         120         105         105  | 38           90         90         75         90         75           75         90         75         90         105           75         105         90         75         90           75         105         90         75         105           75         105         150         150         150           100         105         100         105         105  | 39           75         75         75         75         80           90         90         105         135         120         75           75         75         75         75         120         121           75         75         75         75         120         121           90         102         90         105         90         105         120  | 39           75         75         75         75         105         90           90         90         105         135         120         75           75         90         105         135         120         75           75         75         75         75         120         135           90         102         90         103         135         136           90         102         90         105         155         120           90         120         90         105         75         120  | 40           75         120         90         138         7.5         135           75         163         7.5         7.5         7.5         90           90         90         90         7.5         90         105           105         150         160         90         7.5         105           7         102         7.5         90         105         105  | Yo         120         90         135         75         135           75         102         90         135         75         135           75         105         75         75         76         90           90         90         90         75         90         75           105         150         105         90         75         105           75         102         75         90         105         120  |
| H           135         105         105         105         75           135         105         105         105         90           75         150         105         90         90           76         160         75         75         120         90           90         90         90         75         90         90           100         105         75         105         90         90  | Harticipanti           135         105         105         105         75           135         105         105         105         90           75         150         105         90         90           76         100         75         75         100         90           90         90         90         75         90         90           100         105         75         100         90         90  | H2   | 42           90         105         109         75         105           101         100         100         90         75         105           175         75         75         135         90         105           175         90         75         135         90         105           120         90         105         155         150         105   | H3         1/20           75         75         75         1/20         75           1/20         90         1/35         1/35         90           1/20         1/20         1/35         1/35         90           1/5         1/20         1/35         1/35         1/35           1/35         1/35         1/35         1/35         1/35  | H3         75         75         75         76         70         70         70           75         75         75         75         100         125         90           75         120         105         90         135         160         90           75         120         105         90         150         90           105         75         90         75         105           108         105         75         90         75         105   | 44           75         90         105         120         105           105         90         105         75         90         105           90         90         150         120         105         105           90         90         150         120         105         105           75         75         90         150         120         105           76         75         90         90         155         100   | 44           75         90         100         120         105         75           105         90         105         75         90         105           90         90         150         75         90         105           75         75         155         75         90         105           75         75         155         75         90         105  | 45           120         75         105         90         105         150           120         75         105         76         76  | 45           120         75         105         90         105         100           90         75         75         75         75         75         75           135         105         75         105         90         105         90         105           90         90         120         75         90         90         105         90         105           120         75         75         135         90         90         120         75         90         90  |
| 46           120         105         135         90         75         105           75         90         75         75         90         70           75         75         90         75         75         90           106         120         75         75         90         75           106         120         75         75         90         75   | 46           120         105         135         90         75         105           75         90         75         75         150         90           75         75         90         75         135         90           105         120         75         75         150         90           105         120         90         105         90         90  | 47           IOS 75 90 75 75 90           105 75 90 75 105 120 105         90           105 75 75 120 105         90           105 75 75 120 105         90  | 47           105         75         90         75         90           195         120         15         75         150           90         90         75         105         120           90         75         105         120         105           90         105         75         100         120           90         105         75         100         120   | 48           90         90         75         90         135           120         80         75         90         75           135         75         105         75         105           75         75         135         75         90         105           90         120         105         90         120         105   | 48           90         90         90         90         90         90         90         90         90         90         90         90         90         90         150         90         150         90         150         90         150         150         150         75         150         75         150         75         150 | 49           105 90         75         75         75         75         75         75         90         105         75         90         105         75         90         105         75         90         105         75         90         105         75         90         105         75         90         105         75         10           <th colspan="</td> <td>49           Dot 0         75         75         105         135           109         90         75         70         105         75           109         90         105         75         90         105         75           109         75         90         90         105         75         90         105         75           105         755         105         105         75         105         105         105</td> <td>50           90         150         75         90         90         75         150           75         75         90         90         90         135         90         135           90         75         75         90         135         90         135         90         135           120         105         75         105         75         90         135         90         135           70         75         120         75         105         75         90         135</td> <td>SUPERTICIPATION           90         <b>150 75 90 75 105</b>           90         <b>75 75 90 90 75 105</b>           90         <b>75 90 135 90 105 105</b>           120         <b>105 75 105 75 90 75 75 102 75 108 108</b></td>  | 49           Dot 0         75         75         105         135           109         90         75         70         105         75           109         90         105         75         90         105         75           109         75         90         90         105         75         90         105         75           105         755         105         105         75         105         105         105   | 50           90         150         75         90         90         75         150           75         75         90         90         90         135         90         135           90         75         75         90         135         90         135         90         135           120         105         75         105         75         90         135         90         135           70         75         120         75         105         75         90         135  | SUPERTICIPATION           90 <b>150 75 90 75 105</b> 90 <b>75 75 90 90 75 105</b> 90 <b>75 90 135 90 105 105</b> 120 <b>105 75 105 75 90 75 75 102 75 108 108</b>  |
| 51<br>December Strator           75         90         150         90         120         90           106         75         75         75         105         120           75         105         75         105         75         105         120           90         75         75         105         75         105         131           106         75         105         75         105         90         131  | 51           75         90         150         90         120         90           105         75         75         150         120         90           75         157         75         105         120         90           90         75         75         105         120         90           90         75         75         105         90         75           106         75         75         105         90         75   | 52           90         120         75         90         75         105           90         75         105         75         75         105           90         105         75         75         101         120           90         105         75         75         90         150           106         90         135         136         120         75  | 52           90         120         75         90         57         95         95           90         120         75         90         75         75         75         75         75         75         90         120           90         105         75         75         90         150         120           90         105         75         80         150         120   | 53           90         00         105         156         90           75         75         75         75         105           150         75         105         105         105           120         75         105         105         90           100         75         105         105         90   | 53         53           90         90         105         135         90           75         75         120         75         150           150         75         150         90  | 54           90         75         90         75         90         90           120         105         75         75         75         75           105         75         155         75         150         90           105         75         156         75         150         90           105         75         100         100         100         100           105         75         90         75         100         90           105         75         90         75         100         90  | 54           90         75         90         90         90           120         105         75         75         75         75           105         75         105         75         120         90           105         75         105         75         120         90           105         75         100         90         100         100           105         75         100         90         100         100           105         75         100         90         100         100           105         75         90         75         100         90           105         75         90         75         100         90           105         75         90         75         100         90           105         75         90         75         100         90 | 55           75         90         75         75         90           120         335         76         135         90           75         90         75         135         90           76         90         75         120         105           105         75         105         105         120           106         90         90         75         105  | SS-SUPARTICIPANT           75         90         75         75         90           120         35         75         135         90         90           75         90         75         135         90         90           75         90         75         105         105         105           105         90         90         75         575         90  |
| 56           75         90         75         90         90           75         105         75         90         90           75         105         75         90         75         105           75         105         75         90         75         105           90         75         90         75         105         105           100         75         90         75         105         105           100         105         90         155         105         105  | Solution         Solution | 90         75         105         120         90         90           90         75         105         120         90         90           90         75         75         135         75         75           75         75         120         75         90         105           75         76         120         75         90         105           105         105         120         75         90         105   | S7         S7           90         75         105         120         90         90           90         75         105         125         75         75         155         150           75         75         120         75         90         150         150           75         75         120         75         90         150         150           76         105         120         75         90         150         150         150  | 58         58           90         75         106         90         90         150           90         120         105         155         90         157           90         75         76         90         120         75         76           90         75         76         90         120         75         75  | 90         75         105         90         90           90         120         150         90         90           90         120         15         155         75           157         75         90         120         75           90         75         75         90         120         75           76         136         152         120         152         75  | 59<br>Demonstrator           105         90         105         90         175         150           90         105         75         135         75         120           90         75         75         105         135         150           90         75         120         90         75         105           97         75         90         90         120         75  | 59           105         90         105         90         75         75           90         105         75         153         75         120           90         75         75         105         105         155         160           90         75         120         90         75         105         105           75         75         90         90         75         120         90         75         105   | 60         50         180         180         75         75           90         150         90         183         90         185         75           90         175         90         105         90         75         90           75         90         105         100         120         75         90           105         120         105         120         75         90  | 90         150         90         183         75           90         75         80         80         75           75         90         80         97         75           76         91         90         123         90         135           105         105         120         75         90           105         105         120         75         90   |
| 61           75         135         90         105         150         75           75         105         75         75         90         75           75         105         75         75         90         75           75         90         75         00         75           75         90         75         105         75           75         90         75         105         120  | 61           75         135         90         105         150         75           75         106         75         75         90         75           75         106         75         75         90         75           75         90         90         135         90         90           75         90         90         90         90         90           105         90         90         75         120         75           75         90         75         106         120         120   |  |   |  |  |  |   |   |  |

**Fig. S8.** Proportions of the demonstrator's choices in observational trials (left) and the participant's choices in independent trials (right) over the 30 options (Choice-plus-reward condition).

#### 5. Exploration rates under an alternative definition



**Fig. S9.** Exploration rates based on the combined benchmark with the best option during observation and that directly experienced after independence. Although participants in the Choice-only and Reward-only conditions were not able to discriminate the best option during the observation period, we calculated them as if the best option were known from social information. The exploration rate here became higher than in the original definition, suggesting that quite a few participants failed to set the best option during the observation period as the default for their independent search. The exploration rate was the highest in the Reward-only condition (*Med* = 0.75), moderate in the Choice-only condition (*Med* = 0.52), and the lowest in the Choice-plus-reward condition (*Med* = 0.36). It should be noted the difference between the Choice-only and Choice-plus-reward was not statistically significant in this analysis (Wilcoxon rank-sum test: W = 2263, adjusted p = .053), but the overall pattern did not change qualitatively.

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