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فهرست گزارش سوالات

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مقاله اول: تصمیم‌گیری تحت تاثیر بازخورد

Introduction

This report analyzes how participants performed on a learning task, looking at how complete and partial feedback affected the efficiency of learning and how context affected participants' ability to make decisions. Consistent with previous research, the study's findings show that participants perform significantly better when given complete feedback. During the transfer phase, contextual biases were detected and participants' confidence increased when they made advantageous decisions. The importance of feedback and context in the learning and decision-making processes is highlighted by the results presented here.

Understanding how feedback influences learning and decision-making is critical in cognitive psychology. The performance of participants in a learning task with two types of feedback (complete and partial) is examined in this study. The primary hypothesis is that complete feedback will enhance learning efficiency compared to partial feedback. Additionally, the study explores the contextual effects on preferences during a transfer phase and the accuracy of value estimation.

Participants and Task Design

Participants were divided into two groups, each performing a learning task under either complete or partial feedback conditions. The task involved choosing between two options, with one option offering a higher expected reward.

Performance Assessment

Performance was measured by the percentage of trials in which participants selected the advantageous option in the learning phase. Statistical tests (t-tests) were conducted to compare performance against a random choice baseline (0.5) and between feedback conditions.

Transfer Phase

In the transfer phase, participants chose between new pairs of options. A binomial test was used to assess preference biases between options A1 and A2. Participants reported their confidence in their choices.

Value Estimation

Participants estimated the expected rewards of options. Paired t-tests assessed the accuracy and variability of these estimations.

- Results
  - Performance in Learning Phase

Performance in learning in Partial Feedback is equal to 0.7718 ± 0.4197. Performance in learning in Complete Feedback is equal to 0.8893 ± 0.3138. Confidence interval of performance in learning in Partial Feedback is equal to 0.7718 ± 0.0099. Confidence interval of performance in learning in Complete Feedback is equal to 0.8893 ± 0.0066.

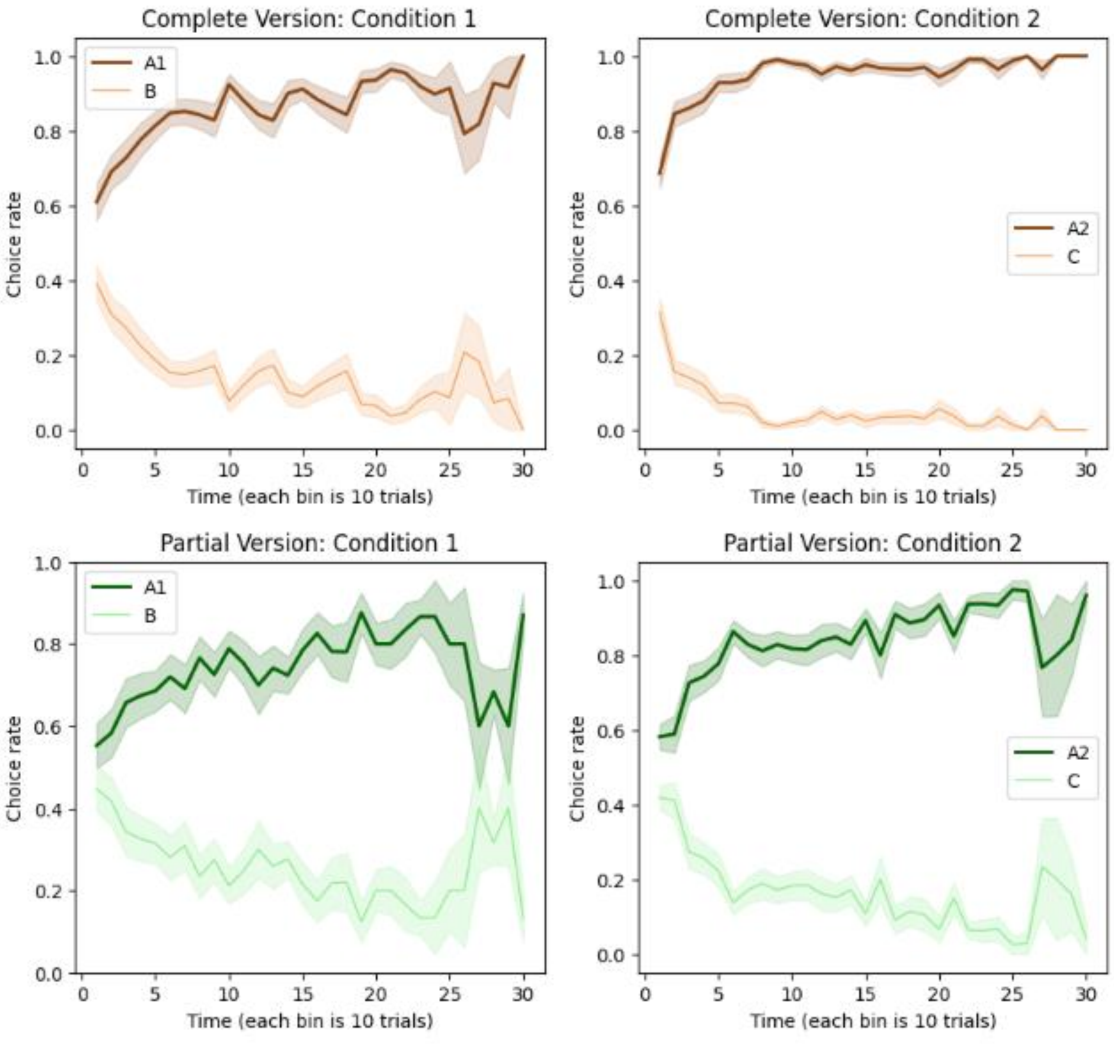

Figure 1. Choice Rate Dynamics Across Complete and Partial Versions in Two Conditions (A_1B, A_2C)

Participants performed significantly better than random in both feedback conditions. Performance in learning in Partial Feedback is significantly greater than 0.5 (t-statistic = 13.6786698959, p-value = 1.1040776109e-15, dof = 34). Performance in learning in Complete Feedback is significantly greater than 0.5 (t-statistic = 29.0488863659, p-value = 2.8382266840e-29, dof = 41).

Performance was significantly higher in the complete feedback condition than in the partial feedback condition (t-statistic = 5.3522, p-value = 4.5603e-07, dof = 75)

Performance in Transfer Phase

Performance in transfer in Partial Feedback is equal to 0.9155 ± 0.2783. Performance in transfer in Complete Feedback is equal to 0.9067 ± 0.2909. Confidence interval of performance in transfer in partial Feedback is equal to CI = 0.9155 ± 0.0188. Confidence interval of performance in transfer in Complete Feedback is equal to CI = 0.9067 ± 0.0180.

Participants performed significantly better than random in both feedback conditions. Performance in transfer in Partial Feedback is significantly greater than 0.5 (t-statistic = 27.1116821404, p-value = 6.5345899686e-25, dof = 34). Performance in transfer in Complete Feedback is significantly greater than 0.5 (t-statistic = 27.2111939478, p-value = 3.6359720297e-28, dof = 41).

Average confidence in Transfer Phase

In Complete version: Average confidence when the option is advantageous is equal to 0.7940 ± 0.2051. Average confidence when the option is not advantageous: 0.6129 ± 0.2103.

In Partial version: Average confidence when the option is advantageous: 0.7555 ± 0.2006. Average confidence when the option is not advantageous: 0.5388 ± 0.2284.

Transfer Phase Preferences

Participants exhibited a preference for option A2 over A1 in both feedback versions, influenced by contextual factors (Partial: Ratio=0.6571, P-value from binomial test=0.0448; Complete: Ratio=0.6667, P-value from binomial test=0.0218). This trend persisted but lost significance when considering all iterations (Partial: T-stat= -1.7854, P-value: 0.0831; Complete: T-stat= -1.9060, P-value= 0.0637).

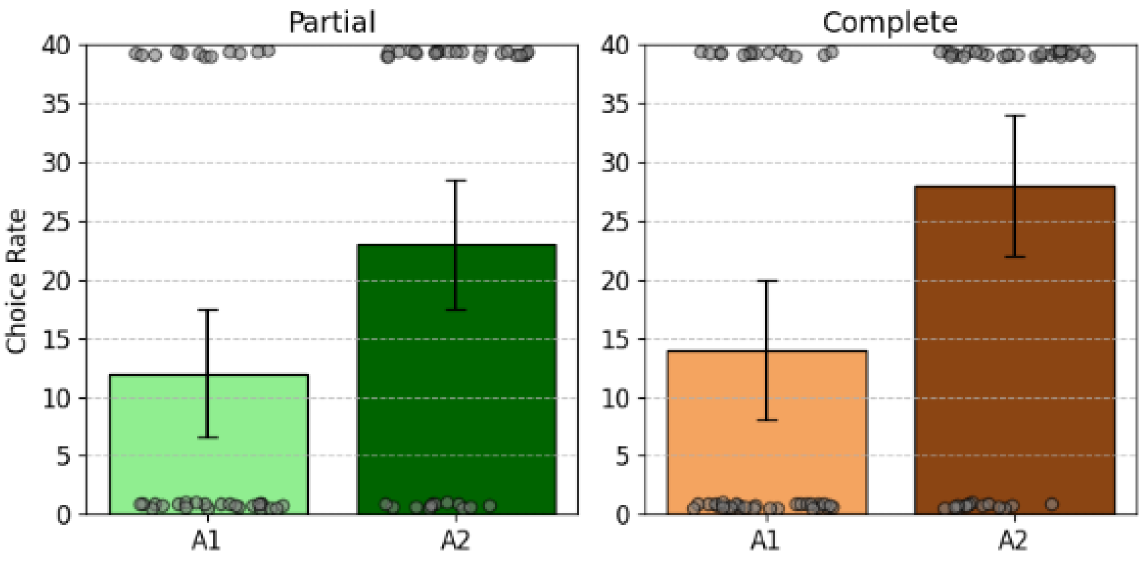

Figure 2. Comparison of Choice Rates for A1 and A2 in Partial and Complete Conditions

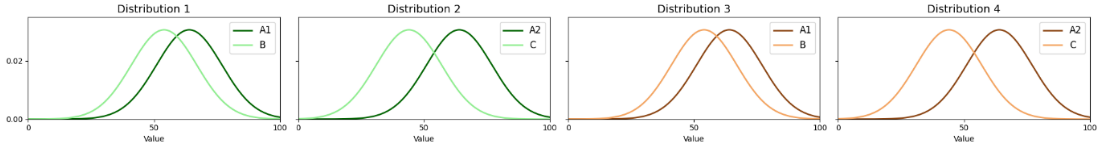

Figure 3. Probability Distributions of Values for A1, A2, B, and C Across Four Conditions

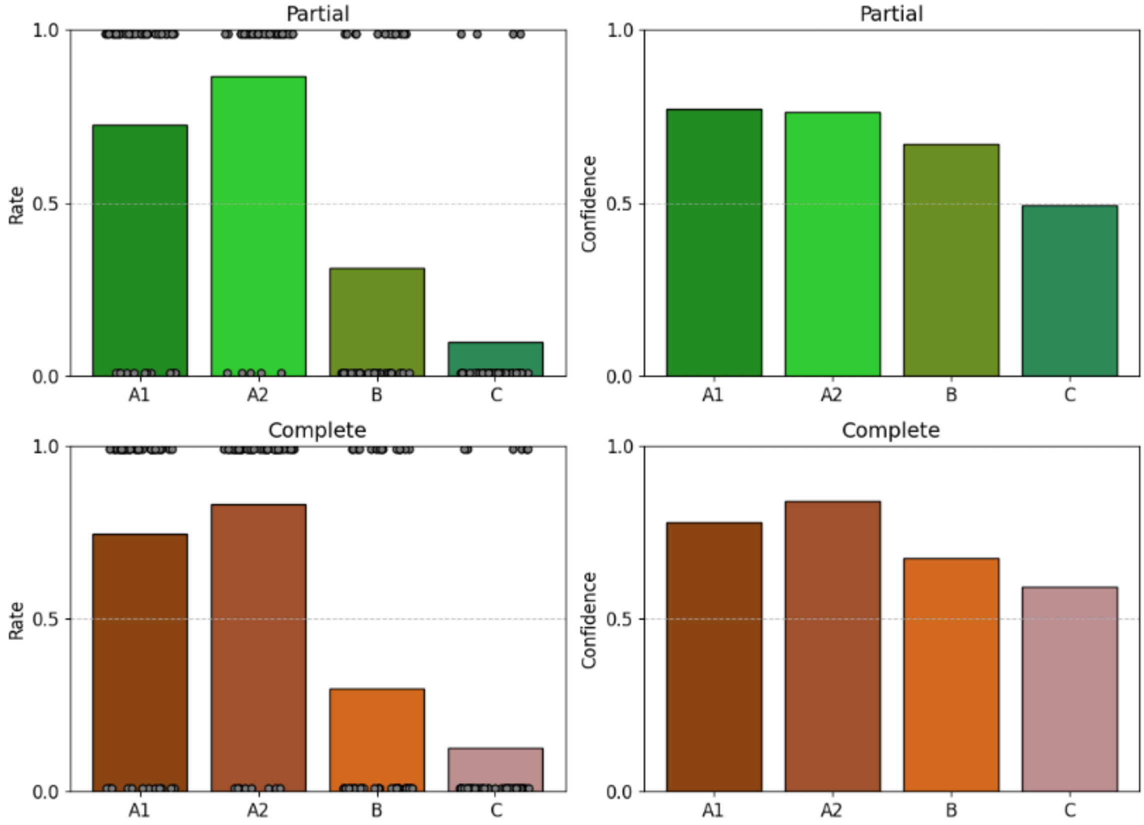

Figure 4. Comparison of Rate and Confidence for Partial and Complete Groups Across A_1, A_2, B, C

- ## Confidence of the feedback versions:

There is no significant difference in confidences between two feedback versions (t-statistic: -1.3233, p-value: 0.1898, degrees of freedom: 75).

- Value Estimation:

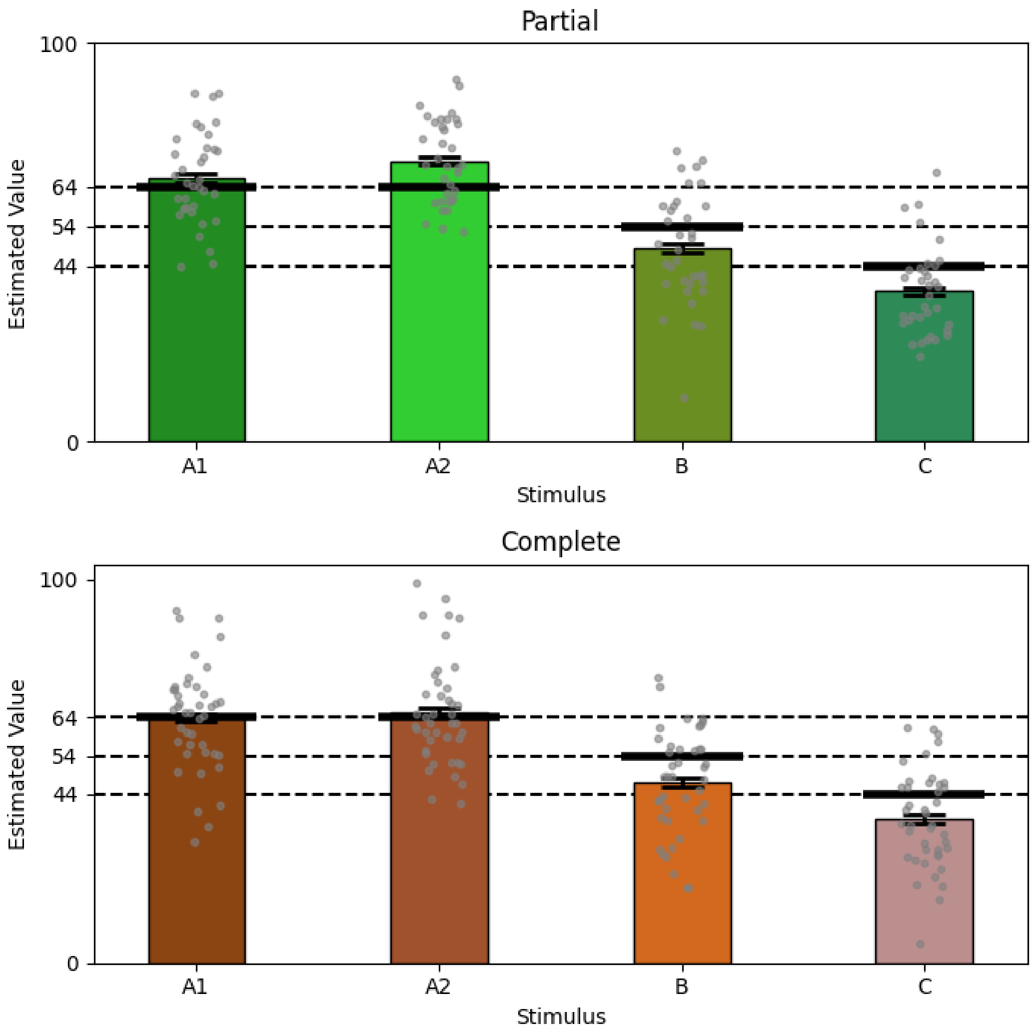

Figure 5. Estimated Value Comparisons for Partial and Complete Stimuli Across A_1, A_2, B, C

There is no significant difference in estimation between A1 and A2 in any of the version feedbacks (Partial: T-statistic: -1.4891, P-value: 0.1457, dof: 34; Complete: T-statistic: -0.4555, P-value: 0.6511, dof: 41).

There is no significant difference in estimation variabilities between the two feedback versions (T-statistic: 0.1411, P-value: 0.8881, dof: 75).

- Results

The described logistic regression was fitted on two utility functions. The optimal parameters for each participant were calculated as follows (As session 5 does not exist, session 6 has been used instead.):

Participant 65:
  Mean-Variance Utility Function: alpha = -0.0104, beta = 0.6887
  Exponential Utility Function: rho = -0.2070, beta = 0.7365
Participant 66:
  Mean-Variance Utility Function: alpha = -0.0002, beta = 0.6841
  Exponential Utility Function: rho = 0.0035, beta = 1.4839
Participant 67:
  Mean-Variance Utility Function: alpha = 1034.2398, beta = 0.3979
  Exponential Utility Function: rho = 0.1458, beta = 1.2001
Participant 68:
  Mean-Variance Utility Function: alpha = -0.0078, beta = 0.6217
  Exponential Utility Function: rho = -0.1353, beta = 1.0627
Participant 69:
  Mean-Variance Utility Function: alpha = -0.0230, beta = 0.6413
  Exponential Utility Function: rho = -0.4152, beta = 0.4946
Participant 70:
  Mean-Variance Utility Function: alpha = 0.0000, beta = 1.0000
  Exponential Utility Function: rho = 0.0816, beta = 2.9758
Participant 71:
  Mean-Variance Utility Function: alpha = -0.0006, beta = 0.5480
  Exponential Utility Function: rho = -0.0136, beta = 1.7399
Participant 72:
  Mean-Variance Utility Function: alpha = -0.0552, beta = 0.3632
  Exponential Utility Function: rho = -0.9314, beta = 0.2858
Participant 73:
  Mean-Variance Utility Function: alpha = -0.0075, beta = 0.6036
  Exponential Utility Function: rho = -0.1501, beta = 1.0098
Participant 74:
  Mean-Variance Utility Function: alpha = 1034.2393, beta = -0.1654
  Exponential Utility Function: rho = 0.0939, beta = 1.3396
Participant 75:
  Mean-Variance Utility Function: alpha = -0.0265, beta = 0.3536
  Exponential Utility Function: rho = -0.4867, beta = 0.7454
Participant 76:
  Mean-Variance Utility Function: alpha = -0.0072, beta = 0.4197
  Exponential Utility Function: rho = -0.1474, beta = 1.4691
Participant 77:
  Mean-Variance Utility Function: alpha = -0.0067, beta = 0.6402
  Exponential Utility Function: rho = -0.1241, beta = 1.0483
Participant 78:

Mean-Variance Utility Function: alpha = -0.0136, beta = 0.4905
Exponential Utility Function: rho = -0.2822, beta = 0.8337
Participant 79:
Mean-Variance Utility Function: alpha = -0.0027, beta = 0.9392
Exponential Utility Function: rho = -0.0531, beta = 0.8892
Participant 80:
Mean-Variance Utility Function: alpha = 0.0000, beta = 1.0000
Exponential Utility Function: rho = 0.0095, beta = 1.3214
Participant 81:
Mean-Variance Utility Function: alpha = -0.0017, beta = 0.6975
Exponential Utility Function: rho = -0.0283, beta = 1.3072
Participant 82:
Mean-Variance Utility Function: alpha = -0.0047, beta = 0.8482
Exponential Utility Function: rho = -0.0786, beta = 0.9233
Participant 83:
Mean-Variance Utility Function: alpha = -0.0007, beta = 0.7190
Exponential Utility Function: rho = 0.0003, beta = 1.4016
Participant 84:
Mean-Variance Utility Function: alpha = 1034.2378, beta = -1.1292
Exponential Utility Function: rho = 0.1692, beta = 1.5543
Participant 85:
Mean-Variance Utility Function: alpha = 0.0042, beta = 0.2072
Exponential Utility Function: rho = 0.0636, beta = 5.9298
Participant 86:
Mean-Variance Utility Function: alpha = -0.0109, beta = 0.9917
Exponential Utility Function: rho = -0.2103, beta = 0.5045
Participant 87:
Mean-Variance Utility Function: alpha = -0.0062, beta = 0.7475
Exponential Utility Function: rho = -0.1303, beta = 0.8565
Participant 88:
Mean-Variance Utility Function: alpha = 1033.6387, beta = -34.2622
Exponential Utility Function: rho = 0.0637, beta = 2.4673
Participant 89:
Mean-Variance Utility Function: alpha = -0.0064, beta = 0.9040
Exponential Utility Function: rho = -0.1134, beta = 0.7780
Participant 90:
Mean-Variance Utility Function: alpha = 0.0000, beta = 1.0000
Exponential Utility Function: rho = 0.3521, beta = 58.2679
Participant 91:
Mean-Variance Utility Function: alpha = 1034.2018, beta = -7.8895
Exponential Utility Function: rho = 0.2480, beta = 4.7130
Participant 92:
Mean-Variance Utility Function: alpha = -0.0054, beta = 0.3556
Exponential Utility Function: rho = -0.1279, beta = 1.8186
Participant 93:
Mean-Variance Utility Function: alpha = 1034.0791, beta = -17.2399
Exponential Utility Function: rho = 0.1639, beta = 4.2349
Participant 94:
Mean-Variance Utility Function: alpha = -0.0107, beta = 0.3525

Exponential Utility Function: rho = -0.1922, beta = 1.5887
Participant 95:
Mean-Variance Utility Function: alpha = 1034.0381, beta = -19.4342
Exponential Utility Function: rho = 0.1742, beta = 4.6149
Participant 96:
Mean-Variance Utility Function: alpha = 0.0026, beta = 0.2656
Exponential Utility Function: rho = 0.0495, beta = 4.4615

Figure. 6 shows four bar plots showing the parameters (alpha, beta for Mean-Variance; rho, beta for Exponential) for each participant. Each subplot corresponds to one parameter, with the x-axis representing the participants and the y-axis representing the parameter values.

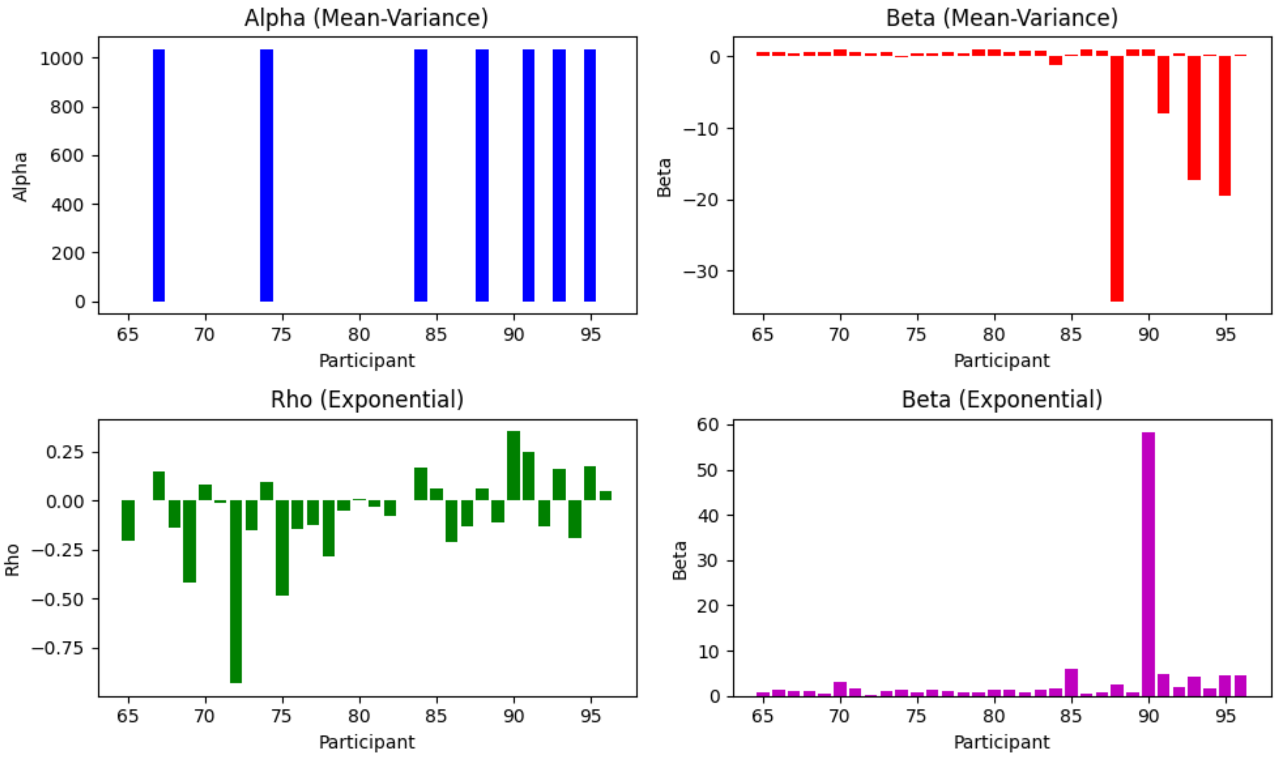

Figure 6. Parameters (alpha, beta for Mean-Variance; rho, beta for Exponential) for each participant

In figure. 7, each row corresponds to a session (1, 3, 6) and each column corresponds to a parameter (alpha, beta for Mean-Variance; rho, beta for Exponential). Each subplot will show the parameter values for each participant in the corresponding session.

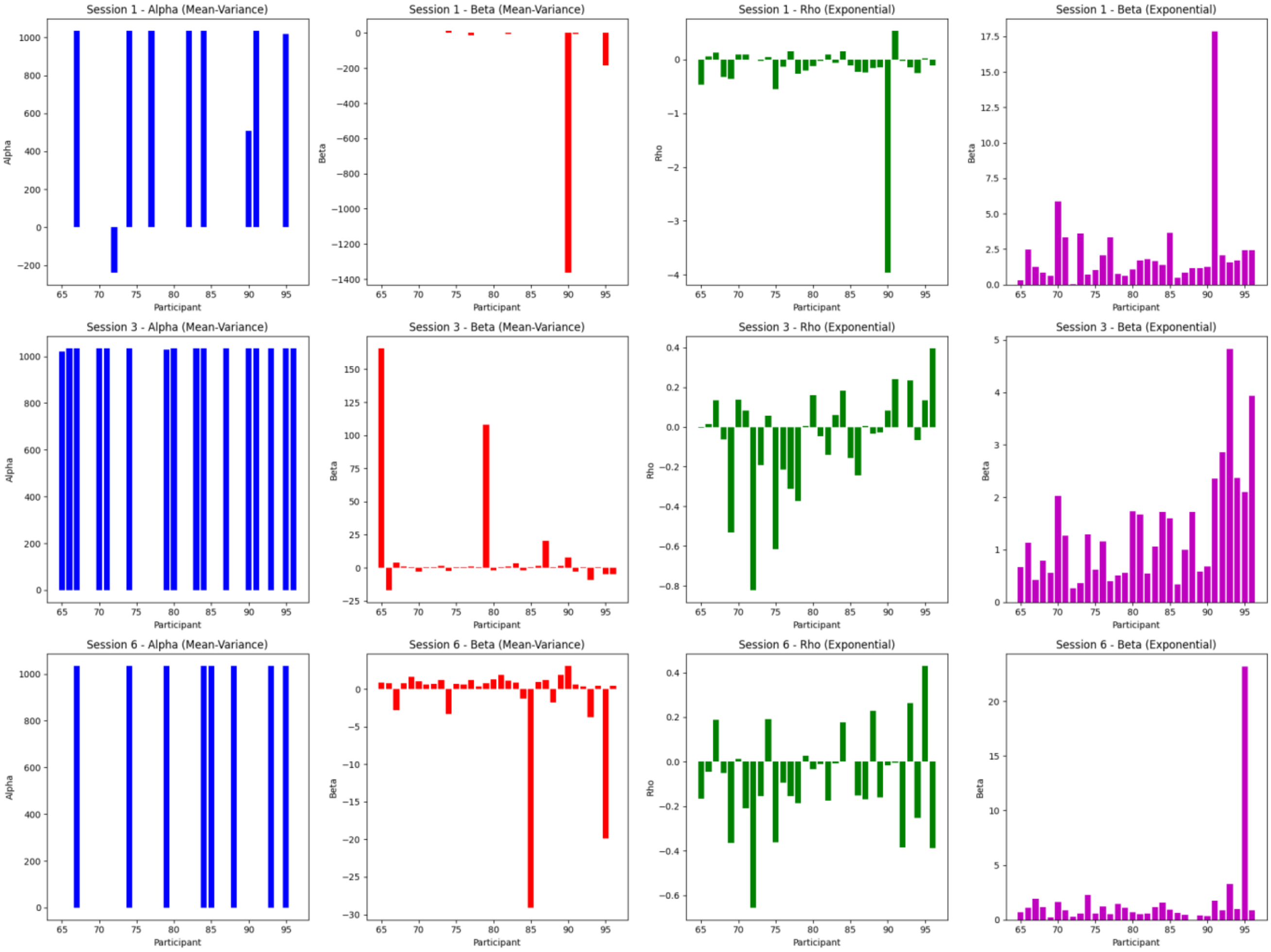

Figure 7. Parameter values for each participant in the corresponding session

▪ Analysis

The logistic regression analysis was conducted on two utility functions—Mean-Variance and Exponential—across multiple participants. The results provide the optimal parameters for each participant, allowing us to analyze patterns and variations across individuals.

▫ Mean-Variance Utility Function

The Mean-Variance utility function is represented by the parameters alpha and beta:

- **Alpha (α)**: Represents the risk aversion of the participant.
- **Beta (β)**: Indicates the sensitivity to variance.

▫ Exponential Utility Function

The Exponential utility function is characterized by the parameters rho and beta:

- **Rho (ρ)**: Represents the degree of risk aversion.

- **Beta (β)**: Reflects the sensitivity to the expected return.

▫ Figure 6: Bar Plots of Parameters

- **Alpha (α) for Mean-Variance Utility Function:**

A notable observation is that alpha values vary significantly among participants. Some participants have positive values (e.g., Participant 85), while others have negative values (e.g., Participants 65, 66).

Participants 67, 74, 84, 88, 91, 93, and 95 have exceptionally high positive values, indicating a different interpretation or possible errors in parameter estimation.

- **Beta (β) for Mean-Variance Utility Function:**

Beta values for the Mean-Variance utility function are mostly positive and hover around values less than 1.

This suggests that most participants have a moderate sensitivity to variance. Participants with beta values exactly equal to 1 (e.g., Participants 70, 80, 90) imply a proportional sensitivity to variance.

- **Rho (ρ) for Exponential Utility Function:**

Rho values range from negative to positive across participants, indicating varied risk aversion.

Negative values suggest risk-averse behavior (e.g., Participant 69), while positive values indicate risk-seeking behavior (e.g., Participant 66).

- **Beta (β) for Exponential Utility Function:**

Beta values in the Exponential utility function also vary widely, with some participants having values close to 1, and others having significantly higher values (e.g., Participant 90 with a beta of 58.2679).

This variation shows the different levels of sensitivity to the expected return among participants.

▫ Figure 7: Parameter Values Across Sessions

- **Consistency and Variability Across Sessions:**

By comparing the parameters across different sessions (1, 3, 6), we can observe the stability of participant behavior over time.

Consistent values across sessions indicate stable preferences and risk attitudes, while significant changes suggest evolving or inconsistent behavior.

- **Alpha and Beta for Mean-Variance Utility Function:**

Analysis of the parameter values across sessions can reveal if participants consistently exhibit the same level of risk aversion (alpha) and sensitivity to variance (beta).

- **Rho and Beta for Exponential Utility Function:**

Similar analysis for rho and beta can show if participants' risk aversion and sensitivity to expected returns change over different sessions.

Outliers and Errors:

The presence of extremely high values for alpha in the Mean-Variance utility function for some participants suggests either outliers or potential errors in parameter estimation.

Behavioral Insights:

The distribution of rho values suggests diverse risk preferences among participants, with some being risk-averse and others risk-seeking.

The variation in beta values for both utility functions indicates that participants have different levels of sensitivity to risk and return.

Comparison of Utility Functions:

Participants with negative alpha and rho values generally exhibit risk-averse behavior in both utility functions.

Those with positive alpha and rho values are generally more risk-seeking.