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```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Main Simulation Script for BoundingOverwatch Project with R Integration
% Randomly 10 trials is used to validate predictions
% DFT Parameters:
% phi1 - sensitivity to attribute differences (typically 0.5-2)
% phi2 - memory/feedback strength (0-1)
% tau - decision time steps (integer > 0)
% error_sd - noise standard deviation ( $\sigma_{\epsilon}$ )
% beta - attribute weights from R estimation
% w - attention weights (default [0.5;0.5])
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
clc;
clear all;
```

Step 1: Import CSV Data

```
(reference apolloMain_5 and apolloMain_6 as example for data manipulation) biasData = readtable('user_choices.csv'); % Replace with the path to your data file disp('User bias data imported successfully.');?>
taskChoice_Data = readtable('user_choices.csv'); % Replace with the path to your data file disp('User task choice data imported successfully.');
```

```
robotChoice_Data = readtable('G:\My Drive\myResearch\Research Experimentation\Apollo\apollo\data\Bounding_Overwatch_Data\HumanData_Bounding_Overwatch - 20Split.csv')
% Convert all column headers to lowercase
robotChoice_Data.Properties.VariableNames = lower(robotChoice_Data.Properties.VariableNames);
disp('User robot choice data imported successfully.');

% Randomly select 10 rows (or all rows if fewer than 10)
numRows = height(robotChoice_Data);
randomIndices = randperm(numRows, min(10, numRows));
robotChoice_Data = robotChoice_Data(randomIndices, :);

% Extract robot state attributes dynamically
robot_states = struct();
attributeSuffixes = {'traversability', 'visibility'}; % No leading underscores
for i = 1:3
    for attr = attributeSuffixes
        csvColName = sprintf('robot%d_%s', i, attr{1}); % Matches CSV column names
        structFieldName = attr{1}; % Valid field name
        if ismember(csvColName, robotChoice_Data.Properties.VariableNames)
            robot_states(['robot' num2str(i)]).(structFieldName) = robotChoice_Data.(csvColName);
        else
            warning('Missing attribute column: %s', csvColName);
            robot_states(['robot' num2str(i)]).(structFieldName) = NaN(height(robotChoice_Data), 1);
        end
    end
end
% Extract choice data and other metadata
choices = robotChoice_Data.choice;
participant_ids = robotChoice_Data.id;
stake_types = robotChoice_Data.stakes;
time_spent = robotChoice_Data.timeelapsed;
```

User robot choice data imported successfully.

Step 2: R Bridge Implementation

```
disp('Initializing R bridge...');

% Configure paths
rscript_path = 'C:\Program Files\R\R-4.4.2\bin\x64\Rscript.exe';
r_script = 'G:\My Drive\myResearch\Research Experimentation\Apollo\apollo\example\MDFT_Bounding_Overwatch.R';
csvFile = 'G:\My Drive\myResearch\Research Experimentation\Apollo\apollo\data\Bounding_Overwatch_Data\HumanData_Bounding_Overwatch - 80Split.csv';
outputDir = 'G:\My Drive\myResearch\Research Experimentation\Apollo\apollo\Output_BoundingOverwatch';

% Verify installations
if ~isfile(rscript_path)
    error('Rscript.exe not found at: %s', rscript_path);
elseif ~isfile(r_script)
    error('R script not found at: %s', r_script);
elseif ~isfile(csvFile)
    error('Input CSV not found at: %s', csvFile);
elseif ~isfolder(outputDir)
    warning('Output folder does not exist, creating: %s', outputDir);
    mkdir(outputDir);
```

```

end

% Execute R with JSON output
try
    % Use proper argument formatting
    cmd = sprintf(['%" "%s ', ...
        '-i %" -o "%s'], ...
        rscript_path, r_script, csvFile, outputDir);

[status,result] = system(cmd);

if status == 0
    % Handle output path (whether directory or file)
    if isfolder(outputDir)
        jsonFile = fullfile(outputDir, 'DFT_output.json');
    else
        jsonFile = outputDir;
    end

    % Parse JSON output
    if exist(jsonFile, 'file')
        jsonText = fileread(jsonFile);
        params = jsondecode(jsonText);

        % Extract parameters with validation
        %Boundedphi1, phi2 parameters
        phi1 = max(0, validateParam(params, 'phi1', 0.5)); % Ensure non-negative
        phi2 = min(max(0, validateParam(params, 'phi2', 0.8)), 1); % Constrain 0-1

        %Raw phi1, phi2 parameters
        %phi1 = validateParam(params, 'phi1', 0.5);
        %phi2 = validateParam(params, 'phi2', 0.8);
        tau = 1 + exp(validateParam(params, 'timesteps', 0.5));
        error_sd = min(max(0.1, validateParam(params, 'error_sd', 0.1)), 1); % still clip here

        % Extract attribute weights
        beta_weights = [
            params.b_attr1;
            params.b_attr2;
            params.b_attr3;
            params.b_attr4
        ];

        % Get initial preferences from ASCs
        initial_P = [
            validateParam(params, 'asc_1', 0);
            validateParam(params, 'asc_2', 0);
            validateParam(params, 'asc_3', 0);
        ];

        disp('Estimated Parameters:');
        disp(['phi1: ', num2str(phi1)]);
        disp(['phi2: ', num2str(phi2)]);
        disp(['tau: ', num2str(tau)]);
        disp(['error_sd: ', num2str(error_sd)]);
        disp('Initial Preferences (from ASCs)');
        disp(initial_P);
    else
        error('R output file not found');
    end
else
    error('R execution failed: %s', result);
end
catch ME
    disp('Error during R execution:');
    disp(getReport(ME, 'extended'));
    [phi1, phi2, tau, error_sd] = getFallbackParams();
    beta_weights = [0.3; 0.2; 0.4; 0.5]; % Default weights
    initial_P = zeros(3,1); % Neutral initial preferences
end

```

Initializing R bridge...

Step 3: MDFT Formulation to Calculate Preference Dynamics

(MDFT calculations based on estimated parameters) Create M matrix from current trial's attributes C11-C14 are consequence attributes for Robot 1 C21-C24 are consequence attributes for Robot 2 C31-C34 are consequence attributes for Robot 3

```

for current_trial = 1:height(robotChoice_Data)
    num_attributes = 4;

    M = [
        robotChoice_Data.c11(current_trial), robotChoice_Data.c12(current_trial), robotChoice_Data.c13(current_trial), robotChoice_Data.c14(current_trial);
        robotChoice_Data.c21(current_trial), robotChoice_Data.c22(current_trial), robotChoice_Data.c23(current_trial), robotChoice_Data.c24(current_trial);

```

```

robotChoice_Data.c31(current_trial), robotChoice_Data.c32(current_trial), robotChoice_Data.c33(current_trial), robotChoice_Data.c34(current_trial)
];

% Normalize M values by dividing by 2 and clamping to [0.01, 1]
%M = M / 2;
%M = max(0.01, min(1, M));

% --- Global Max Normalization ---
global_max = max(robotChoice_Data{:, {'c11','c12','c13','c14','c21','c22','c23','c24','c31','c32','c33','c34'}}, [], 'all', 'omitnan');
if ~isfinite(global_max) || global_max <= 0
    global_max = 1; % fallback in case of zero or NaN
end

M = M / global_max;           % Normalize by global max
M = max(0.01, min(1, M));    % Clamp to [0.01, 1]

attributes = {'C1 - Easy Nav, Low Exposure', 'C2 - Hard Nav, Low Exposure', 'C3 - Easy Nav, High Exposure', 'C4 - Hard Nav, High Exposure'};
beta = beta_weights ./ sum(abs(beta_weights));
beta = beta';

[E_P, V_P, choice_probs, P_tau] = calculateDFTdynamics(...

phi1, phi2, tau, error_sd, beta, M, initial_P);

% Display results for the trial
disp('== Trial Analysis ==');
disp(['Trial: ', num2str(current_trial)]);
disp(['Participant: ', num2str(participant_ids(current_trial))]);
disp(['Actual Choice: Robot ', num2str(choices(current_trial))]);

disp('M matrix (alternatives x attributes):');
disp(array2table(M, ...
    'RowNames', {'Robot1','Robot2','Robot3'}, ...
    'VariableNames', attributes));

disp('DFT Results:');
disp(['E_P: ', num2str(E_P, '%.2f ')]);
disp(['Choice probabilities: ', num2str(choice_probs, '%.3f ')]);
 [~, predicted_choice] = max(choice_probs);
disp(['Predicted choice: Robot ', num2str(predicted_choice)]);
disp(['Actual choice: Robot ', num2str(choices(current_trial))]);
disp('');

if predicted_choice == choices(current_trial)
    disp('✓ Prediction matches actual choice');
else
    disp('✗ Prediction differs from actual choice');
end

% Plot evolution
figure;
plot(0:tau, P_tau);
xlabel('Preference Step (\tau)');
ylabel('Preference Strength');
legend({'Robot1','Robot2','Robot3'});
title(sprintf('Preference Evolution (Trial %d)', current_trial));
grid on;
end
%{

%% Step 4: Output Results
disp('Saving results to CSV...');
output_table = table(E_P, V_P, P_tau(end,:)), ...
    'VariableNames', {'ExpectedPreference', 'VariancePreference', 'FinalPreferences'});
writetable(output_table, 'results.csv');
disp('Results saved successfully!');
%}

```

```

== Trial Analysis ==
Trial: 1
Participant: 141831
Actual Choice: Robot 1
M matrix (alternatives x attributes):
      C1 - Easy Nav, Low Exposure   C2 - Hard Nav, Low Exposure   C3 - Easy Nav, High Exposure   C4 - Hard Nav, High Exposure
Robot1          0.80176            0.44172            0.44022            0.080176
Robot2          0.7462             0.37523            0.44559            0.07462
Robot3          0.68688            0.37097            0.38459            0.068688

DFT Results:
E_P: -98.77   -6.44  105.40
Choice probabilities: 0.000  0.000  1.000
Predicted choice: Robot 3
Actual choice: Robot 1

✗ Prediction differs from actual choice
== Trial Analysis ==

```

Trial: 2

Participant: 141831

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.61224	0.3169	0.35656	0.061224
Robot2	0.57197	0.27241	0.35675	0.057197
Robot3	0.613	0.31344	0.36086	0.0613

DFT Results:

E_P: -21.75 45.91 -23.97

Choice probabilities: 0.000 1.000 0.000

Predicted choice: Robot 2

Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 3

Participant: 141831

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.70809	0.39367	0.38523	0.070809
Robot2	0.70486	0.39044	0.3849	0.070486
Robot3	0.68214	0.3972	0.35316	0.068214

DFT Results:

E_P: -18.43 -12.91 31.53

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 3

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 4

Participant: 141831

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.71806	0.45013	0.33973	0.071806
Robot2	0.74936	0.48659	0.33771	0.074936
Robot3	0.68863	0.41437	0.34312	0.068863

DFT Results:

E_P: 1.22 -50.95 49.92

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 5

Participant: 141831

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.9603	0.56906	0.48728	0.09603
Robot2	0.9396	0.56332	0.47025	0.09396
Robot3	0.92513	0.52296	0.49468	0.092513

DFT Results:

E_P: -31.86 6.37 25.68

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 6

Participant: 141831

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.76739	0.45252	0.39161	0.076739
Robot2	0.80526	0.46975	0.41603	0.080526
Robot3	0.69717	0.38283	0.38459	0.069717

DFT Results:
 E_P : -16.88 -85.40 102.47
 Choice probabilities: 0.000 0.000 1.000
 Predicted choice: Robot 3
 Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 7

Participant: 141831

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.64668	0.28396	0.42739	0.064668
Robot2	0.77854	0.43903	0.41736	0.077854
Robot3	0.82116	0.45844	0.44484	0.082116

DFT Results:
 E_P : 172.19 -47.38 -124.63
 Choice probabilities: 1.000 0.000 0.000
 Predicted choice: Robot 1
 Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 8

Participant: 141831

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.66638	0.38256	0.35045	0.066638
Robot2	0.70026	0.39055	0.37974	0.070026
Robot3	0.66616	0.39667	0.3361	0.066616

DFT Results:
 E_P : 19.94 -42.87 23.11
 Choice probabilities: 0.040 0.000 0.960
 Predicted choice: Robot 3
 Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 9

Participant: 141831

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.75534	0.43483	0.39604	0.075534
Robot2	0.82859	0.46243	0.44901	0.082859
Robot3	0.77114	0.47827	0.36999	0.077114

DFT Results:
 E_P : 51.77 -81.95 30.36
 Choice probabilities: 1.000 0.000 0.000
 Predicted choice: Robot 1
 Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 10

Participant: 141831

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.80532	0.45553	0.43032	0.080532
Robot2	0.72323	0.38538	0.41017	0.072323
Robot3	0.68177	0.35777	0.39218	0.068177

DFT Results:
 E_P : -119.02 23.01 96.20
 Choice probabilities: 0.000 0.000 1.000
 Predicted choice: Robot 3
 Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 11

Participant: 141831

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.89676	0.48518	0.50126	0.089676
Robot2	0.90166	0.49089	0.50094	0.090166
Robot3	0.91416	0.50958	0.496	0.091416

DFT Results:

E_P: 12.20 4.05 -16.06

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 1

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 12

Participant: 141831

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.72313	0.44866	0.34678	0.072313
Robot2	0.64337	0.42982	0.27788	0.064337
Robot3	0.70575	0.41968	0.35665	0.070575

DFT Results:

E_P: -58.29 89.63 -31.15

Choice probabilities: 0.000 1.000 0.000

Predicted choice: Robot 2

Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 13

Participant: 141831

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.79798	0.448	0.42977	0.079798
Robot2	0.86018	0.49473	0.45147	0.086018
Robot3	0.88575	0.50864	0.46568	0.088575

DFT Results:

E_P: 87.95 -20.92 -66.85

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 14

Participant: 141831

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.61684	0.31126	0.36726	0.061684
Robot2	0.76833	0.45944	0.38572	0.076833
Robot3	0.75138	0.41743	0.40908	0.075138

DFT Results:

E_P: 164.35 -93.93 -70.24

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 15

Participant: 141831

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.90298	0.53897	0.4543	0.090298
Robot2	0.86342	0.49748	0.45228	0.086342
Robot3	0.91636	0.55042	0.45758	0.091636

DFT Results:

E_P: -14.50 52.41 -37.73

Choice probabilities: 0.000 1.000 0.000

Predicted choice: Robot 2
Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 16

Participant: 141831

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.68014	0.39545	0.3527	0.068014
Robot2	0.50899	0.23805	0.32183	0.050899
Robot3	0.48043	0.23851	0.28997	0.048043

DFT Results:

E_P: -213.95 79.92 134.21

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 17

Participant: 141831

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.78279	0.4359	0.42517	0.078279
Robot2	0.96171	0.56453	0.49335	0.096171
Robot3	0.89517	0.51322	0.47147	0.089517

DFT Results:

E_P: 170.93 -143.43 -27.32

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 18

Participant: 141831

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.62822	0.36381	0.32723	0.062822
Robot2	0.58631	0.35617	0.28877	0.058631
Robot3	0.49507	0.22624	0.31833	0.049507

DFT Results:

E_P: -101.16 -22.98 124.32

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 19

Participant: 141831

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.62822	0.36381	0.32723	0.062822
Robot2	0.58631	0.35617	0.28877	0.058631
Robot3	0.49507	0.22624	0.31833	0.049507

DFT Results:

E_P: -101.16 -22.98 124.32

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 20

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
--	-----------------------------	-----------------------------	------------------------------	------------------------------

Robot1	0.85428	0.49858	0.44112	0.085428
Robot2	0.90414	0.50976	0.48479	0.090414
Robot3	0.95033	0.59979	0.44557	0.095033

DFT Results:
E_P: 85.05 -7.51 -77.35
Choice probabilities: 1.000 0.000 0.000
Predicted choice: Robot 1
Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 21

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.81845	0.50894	0.39136	0.081845
Robot2	0.75401	0.45342	0.37599	0.075401
Robot3	0.75254	0.46088	0.36691	0.075254

DFT Results:
E_P: -75.61 35.80 40.00
Choice probabilities: 0.000 0.015 0.985
Predicted choice: Robot 3
Actual choice: Robot 3

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 22

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.67328	0.37631	0.36431	0.067328
Robot2	0.78381	0.47045	0.39174	0.078381
Robot3	0.72364	0.38314	0.41286	0.072364

DFT Results:
E_P: 95.29 -95.95 0.84
Choice probabilities: 1.000 0.000 0.000
Predicted choice: Robot 1
Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 23

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.71344	0.4198	0.36499	0.071344
Robot2	0.61929	0.34323	0.33799	0.061929
Robot3	0.67399	0.38246	0.35893	0.067399

DFT Results:
E_P: -76.98 86.70 -9.54
Choice probabilities: 0.000 1.000 0.000
Predicted choice: Robot 2
Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 24

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.90513	0.50861	0.48703	0.090513
Robot2	0.85394	0.50053	0.43881	0.085394
Robot3	0.94031	0.54746	0.48688	0.094031

DFT Results:
E_P: -12.13 83.62 -71.30
Choice probabilities: 0.000 1.000 0.000
Predicted choice: Robot 2
Actual choice: Robot 2

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 25

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.81229	0.50164	0.39188	0.081229
Robot2	0.67559	0.37157	0.37158	0.067559
Robot3	0.71116	0.3972	0.38508	0.071116

DFT Results:

E_P: -134.97 98.88 36.27

Choice probabilities: 0.000 1.000 0.000

Predicted choice: Robot 2

Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 26

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.72192	0.43444	0.35968	0.072192
Robot2	0.75874	0.46336	0.37125	0.075874
Robot3	0.77245	0.47465	0.37505	0.077245

DFT Results:

E_P: 50.81 -13.36 -37.27

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 1

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 27

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.6495	0.3728	0.34165	0.06495
Robot2	0.65433	0.38537	0.3344	0.065433
Robot3	0.59555	0.32968	0.32542	0.059555

DFT Results:

E_P: -29.01 -35.65 64.84

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 28

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.77336	0.46111	0.38959	0.077336
Robot2	0.81519	0.43726	0.45946	0.081519
Robot3	0.87522	0.48199	0.48075	0.087522

DFT Results:

E_P: 91.36 7.04 -98.22

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 29

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.80027	0.48219	0.3981	0.080027
Robot2	0.74221	0.44871	0.36772	0.074221

Robot3 0.75305 0.4377 0.39065 0.075305

DFT Results:
E_P: -61.43 42.27 19.35
Choice probabilities: 0.000 1.000 0.000
Predicted choice: Robot 2
Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 30

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.95637	0.53302	0.51899	0.095637
Robot2	0.79852	0.43707	0.44131	0.079852
Robot3	0.8528	0.46603	0.47206	0.08528

DFT Results:

E_P: -154.71 126.20 28.70

Choice probabilities: 0.000 1.000 0.000

Predicted choice: Robot 2

Actual choice: Robot 2

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 31

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.60618	0.33049	0.3363	0.060618
Robot2	0.60363	0.31107	0.35293	0.060363
Robot3	0.64021	0.36839	0.33584	0.064021

DFT Results:

E_P: 18.80 19.76 -38.38

Choice probabilities: 0.277 0.723 0.000

Predicted choice: Robot 2

Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 32

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.68796	0.32045	0.4363	0.068796
Robot2	0.82131	0.44309	0.46035	0.082131
Robot3	0.80911	0.4245	0.46552	0.080911

DFT Results:

E_P: 146.21 -82.69 -63.34

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 1

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 33

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.70803	0.41994	0.35888	0.070803
Robot2	0.64935	0.39777	0.31651	0.064935
Robot3	0.66047	0.42178	0.30473	0.066047

DFT Results:

E_P: -65.90 41.25 24.83

Choice probabilities: 0.000 1.000 0.000

Predicted choice: Robot 2

Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 34

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.95922	0.5659	0.48924	0.095922
Robot2	0.9324	0.55776	0.46788	0.09324
Robot3	0.89428	0.52784	0.45587	0.089428

DFT Results:

E_P: -54.99 -5.59 60.77

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 3

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 35

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.57882	0.34199	0.29471	0.057882
Robot2	0.64485	0.39874	0.3106	0.064485
Robot3	0.44093	0.16696	0.31806	0.044093

DFT Results:

E_P: -37.54 -151.69 189.42

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 36

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.9873	0.51895	0.56709	0.09873
Robot2	0.93653	0.52362	0.50656	0.093653
Robot3	1	0.53711	0.56289	0.1

DFT Results:

E_P: -25.59 71.94 -46.16

Choice probabilities: 0.000 1.000 0.000

Predicted choice: Robot 2

Actual choice: Robot 2

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 37

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.60624	0.29893	0.36794	0.060624
Robot2	0.66043	0.32991	0.39657	0.066043
Robot3	0.68441	0.35678	0.39606	0.068441

DFT Results:

E_P: 78.02 -18.77 -59.07

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 3

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 38

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.86196	0.50784	0.44032	0.086196
Robot2	0.80152	0.46803	0.41364	0.080152
Robot3	0.82361	0.48668	0.41929	0.082361

DFT Results:

E_P: -58.46 48.50 10.14
 Choice probabilities: 0.000 1.000 0.000
 Predicted choice: Robot 2
 Actual choice: Robot 2

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 39

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.67898	0.40787	0.33901	0.067898
Robot2	0.54032	0.28954	0.30481	0.054032
Robot3	0.54005	0.26348	0.33058	0.054005

DFT Results:

E_P: -158.27 81.65 76.81
 Choice probabilities: 0.000 0.992 0.008
 Predicted choice: Robot 2
 Actual choice: Robot 2

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 40

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.86499	0.48824	0.46325	0.086499
Robot2	0.81386	0.46521	0.43004	0.081386
Robot3	0.9026	0.5305	0.46236	0.09026

DFT Results:

E_P: -9.78 82.85 -72.89
 Choice probabilities: 0.000 1.000 0.000
 Predicted choice: Robot 2
 Actual choice: Robot 3

✗ Prediction differs from actual choice

== Trial Analysis ==

Trial: 41

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.86499	0.48824	0.46325	0.086499
Robot2	0.81386	0.46521	0.43004	0.081386
Robot3	0.9026	0.5305	0.46236	0.09026

DFT Results:

E_P: -9.78 82.85 -72.89
 Choice probabilities: 0.000 1.000 0.000
 Predicted choice: Robot 2
 Actual choice: Robot 2

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 42

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.74049	0.41046	0.40408	0.074049
Robot2	0.73386	0.44041	0.36684	0.073386
Robot3	0.67296	0.36084	0.37941	0.067296

DFT Results:

E_P: -45.61 -26.97 72.76
 Choice probabilities: 0.000 0.000 1.000
 Predicted choice: Robot 3
 Actual choice: Robot 3

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 43

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.67104	0.33386	0.40428	0.067104
Robot2	0.84462	0.4986	0.43048	0.084462
Robot3	0.83315	0.47276	0.4437	0.083315

DFT Results:
E_P: 192.53 -104.43 -87.91
Choice probabilities: 1.000 0.000 0.000
Predicted choice: Robot 1
Actual choice: Robot 1

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 44

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.74829	0.48906	0.33406	0.074829
Robot2	0.74608	0.46667	0.35402	0.074608
Robot3	0.8094	0.49722	0.39312	0.08094

DFT Results:
E_P: 38.37 38.10 -76.29
Choice probabilities: 0.568 0.432 0.000
Predicted choice: Robot 1
Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 45

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.86603	0.50839	0.44424	0.086603
Robot2	0.91666	0.56963	0.4387	0.091666
Robot3	0.85633	0.5091	0.43286	0.085633

DFT Results:
E_P: 21.87 -62.07 40.38
Choice probabilities: 0.000 0.000 1.000
Predicted choice: Robot 3
Actual choice: Robot 3

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 46

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.6733	0.34971	0.39092	0.06733
Robot2	0.62041	0.35907	0.32338	0.062041
Robot3	0.57198	0.32498	0.3042	0.057198

DFT Results:
E_P: -96.64 5.85 90.98
Choice probabilities: 0.000 0.000 1.000
Predicted choice: Robot 3
Actual choice: Robot 1

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 47

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.6733	0.34971	0.39092	0.06733
Robot2	0.62041	0.35907	0.32338	0.062041
Robot3	0.57198	0.32498	0.3042	0.057198

DFT Results:
E_P: -96.64 5.85 90.98
Choice probabilities: 0.000 0.000 1.000
Predicted choice: Robot 3

Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 48

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.62356	0.39121	0.29471	0.062356
Robot2	0.91084	0.53149	0.47043	0.091084
Robot3	0.81086	0.45317	0.43877	0.081086

DFT Results:

E_P: 287.36 -230.73 -56.44

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 1

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 49

Participant: 125802

Actual Choice: Robot 2

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.55178	0.36025	0.24671	0.055178
Robot2	0.57742	0.33689	0.29827	0.057742
Robot3	0.66364	0.39475	0.33526	0.066364

DFT Results:

E_P: 86.49 33.07 -119.37

Choice probabilities: 1.000 0.000 0.000

Predicted choice: Robot 1

Actual choice: Robot 2

X Prediction differs from actual choice

== Trial Analysis ==

Trial: 50

Participant: 125802

Actual Choice: Robot 3

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.70591	0.36725	0.40924	0.070591
Robot2	0.82798	0.47938	0.4314	0.082798
Robot3	0.65697	0.35478	0.36788	0.065697

DFT Results:

E_P: 39.76 -169.82 130.25

Choice probabilities: 0.000 0.000 1.000

Predicted choice: Robot 3

Actual choice: Robot 3

✓ Prediction matches actual choice

== Trial Analysis ==

Trial: 51

Participant: 125802

Actual Choice: Robot 1

M matrix (alternatives x attributes):

	C1 - Easy Nav, Low Exposure	C2 - Hard Nav, Low Exposure	C3 - Easy Nav, High Exposure	C4 - Hard Nav, High Exposure
Robot1	0.64641	0.37934	0.33171	0.064641
Robot2	0.75924	0.45091	0.38426	0.075924
Robot3	0.71193	0.43016	0.35296	0.071193

DFT Results:

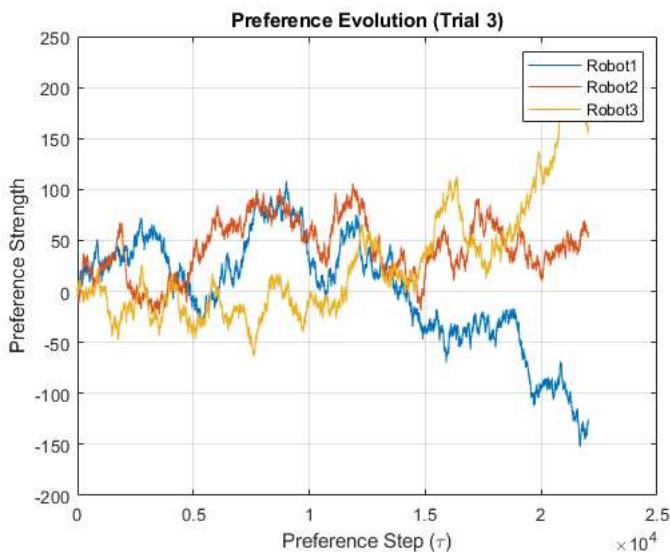
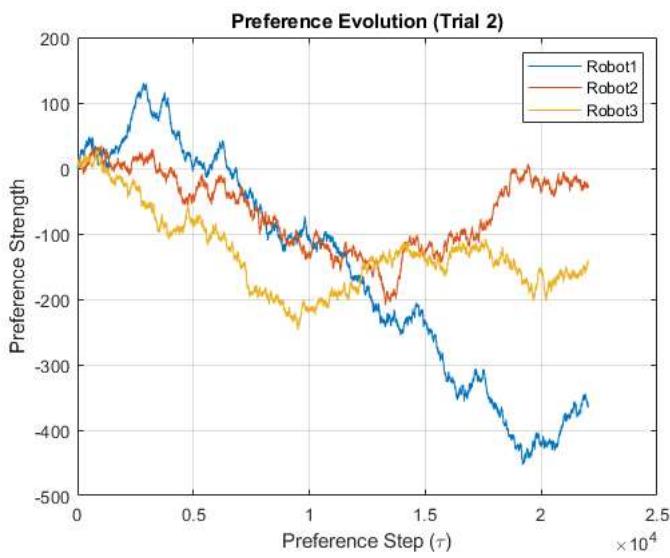
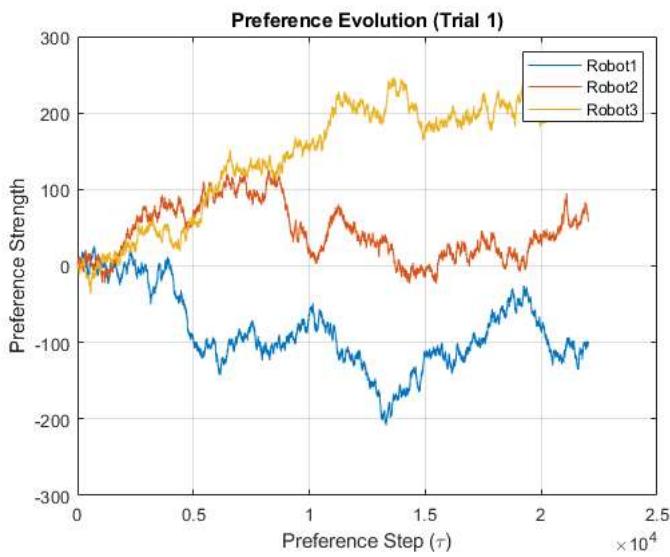
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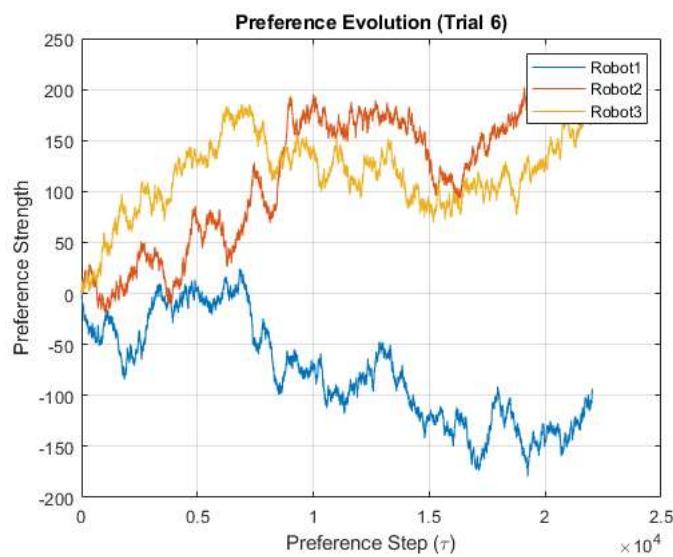
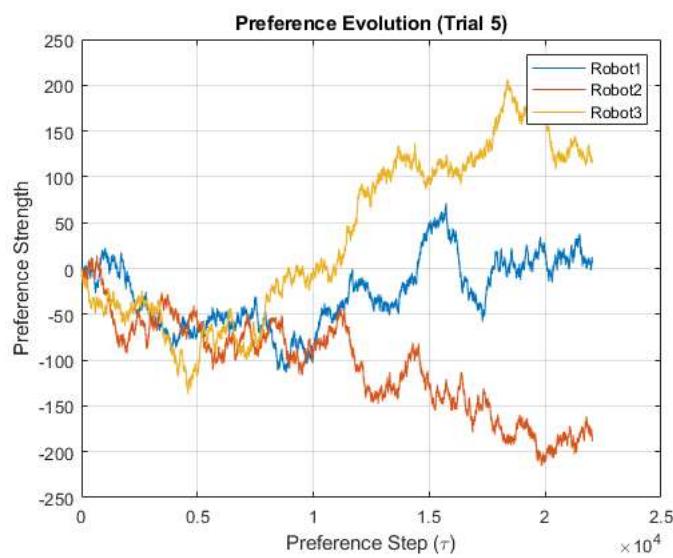
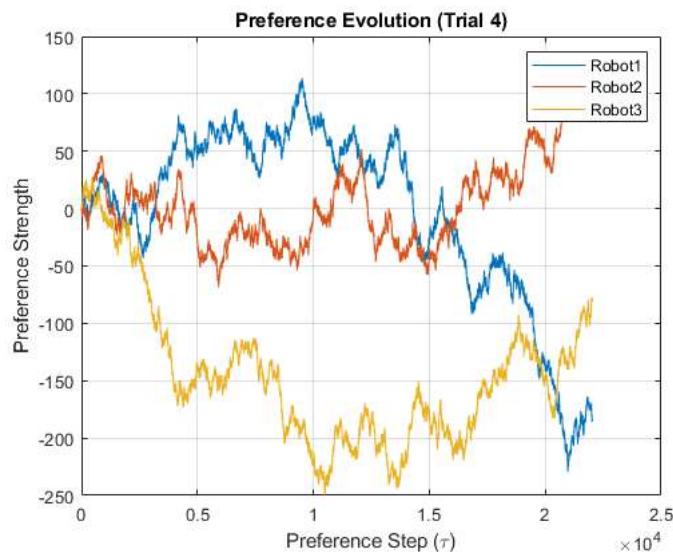
Choice probabilities: 1.000 0.000 0.000

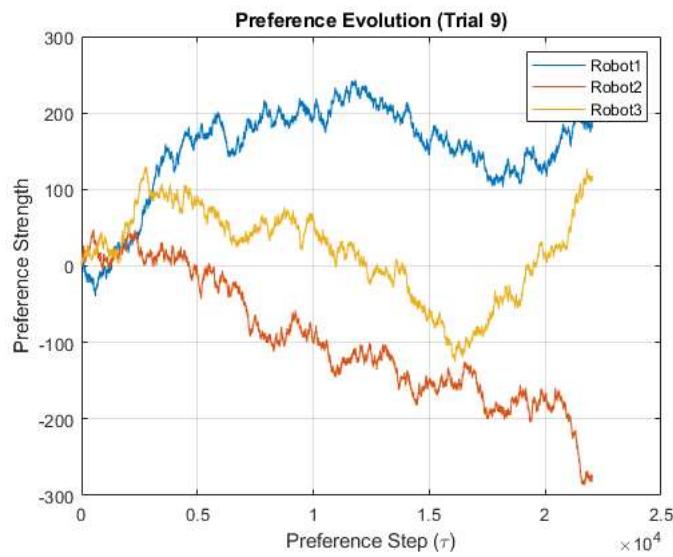
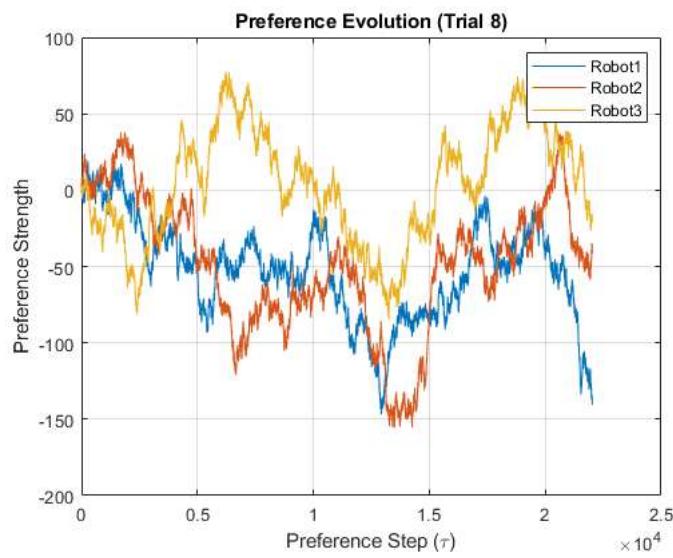
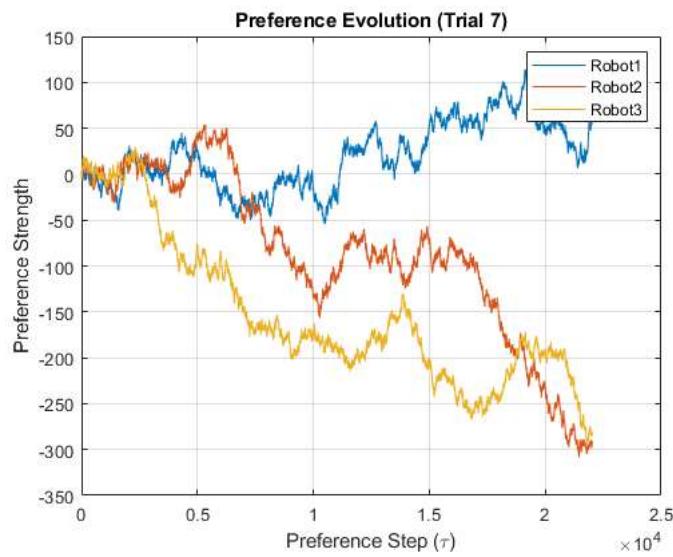
Predicted choice: Robot 1

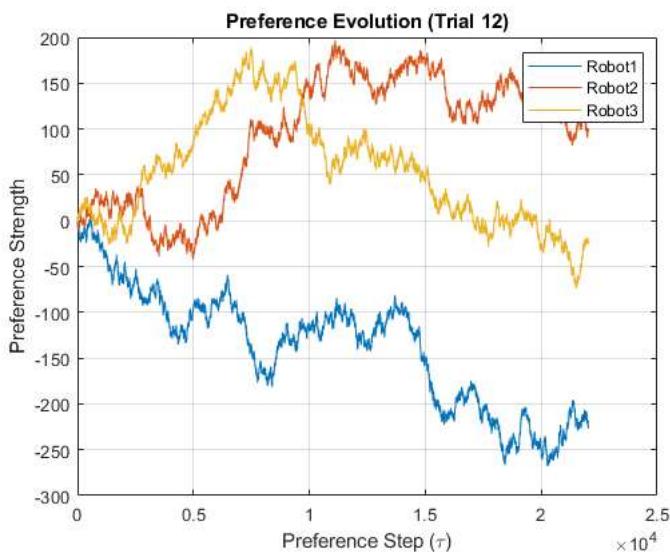
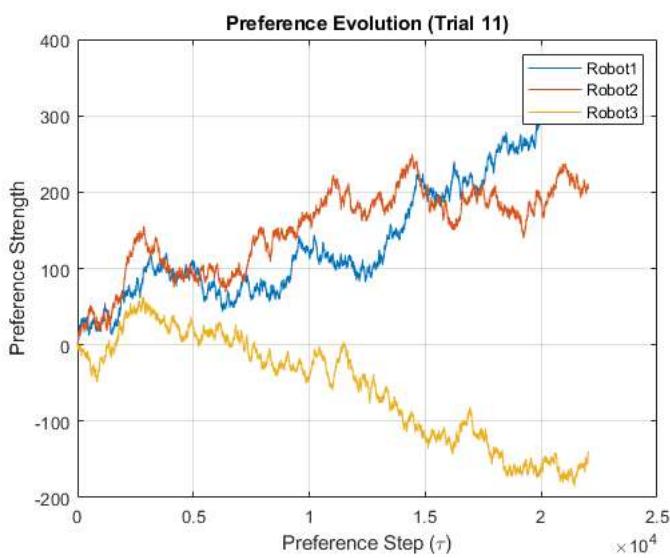
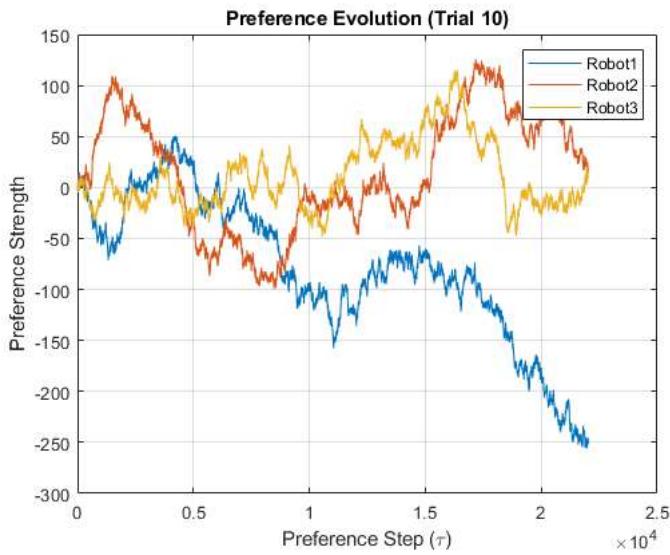
Actual choice: Robot 1

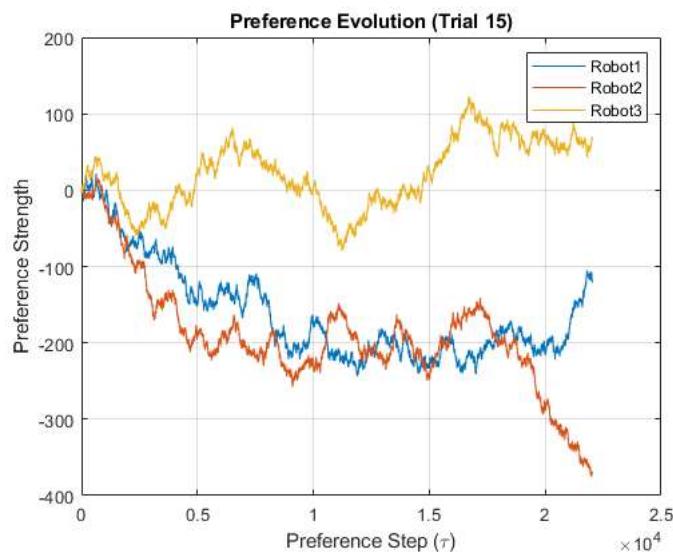
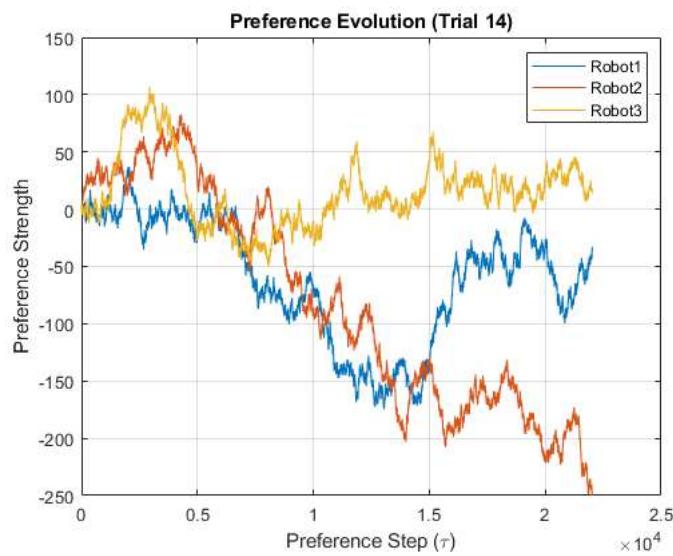
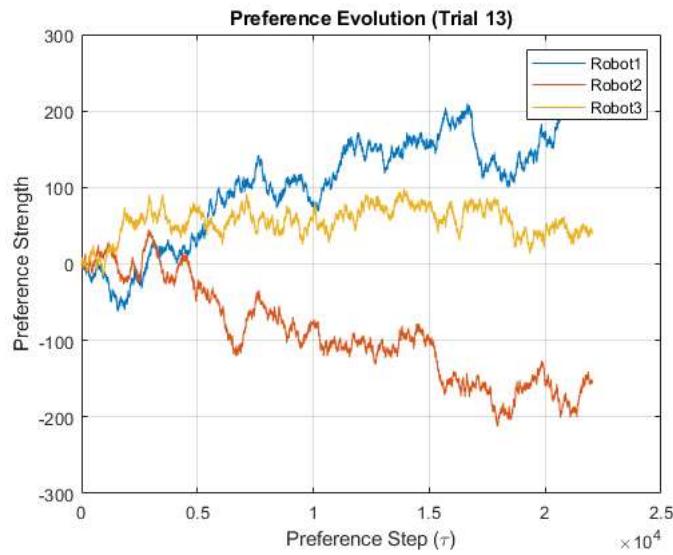
✓ Prediction matches actual choice

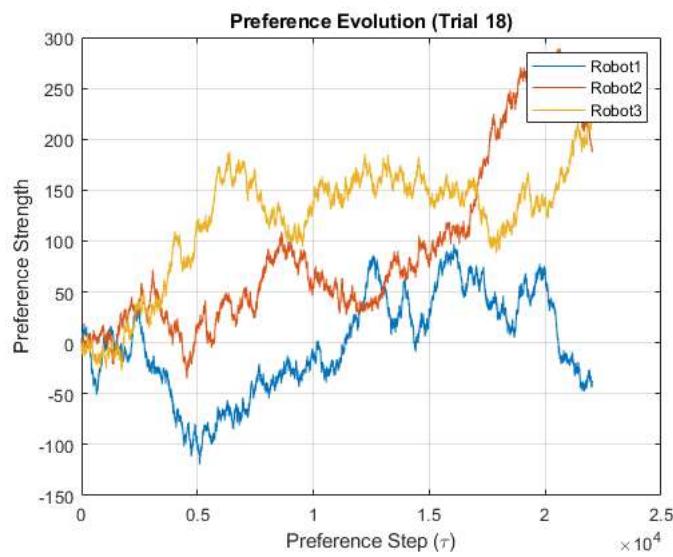
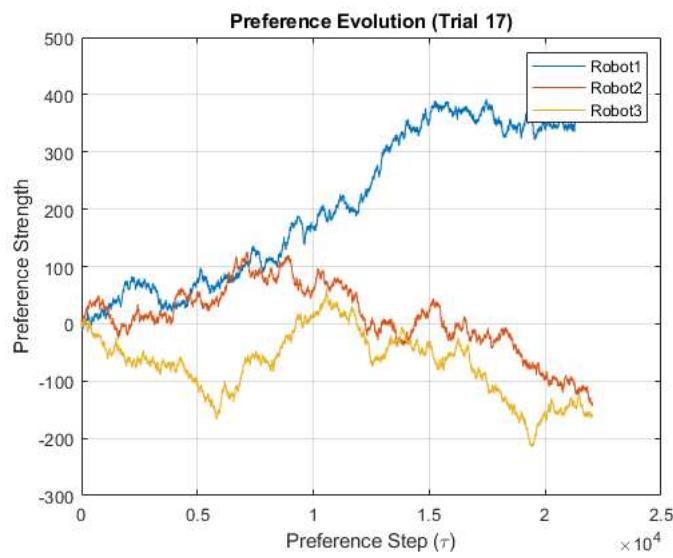
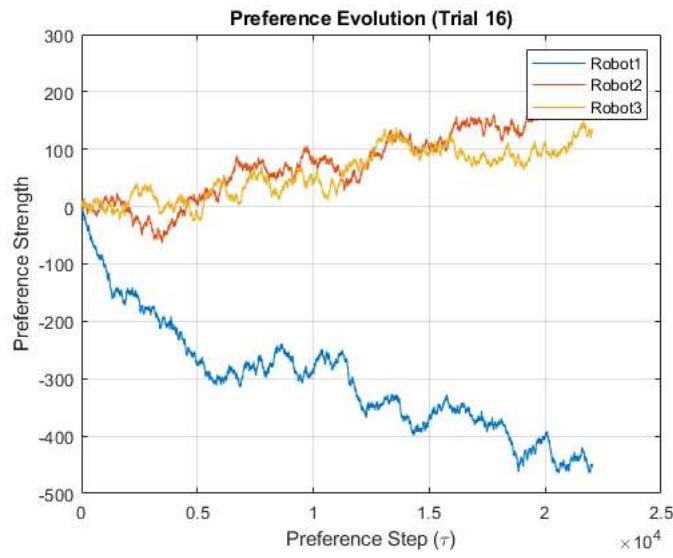


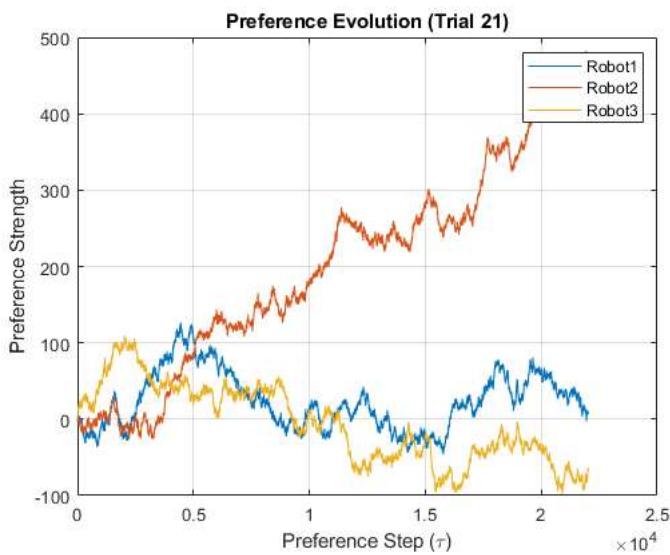
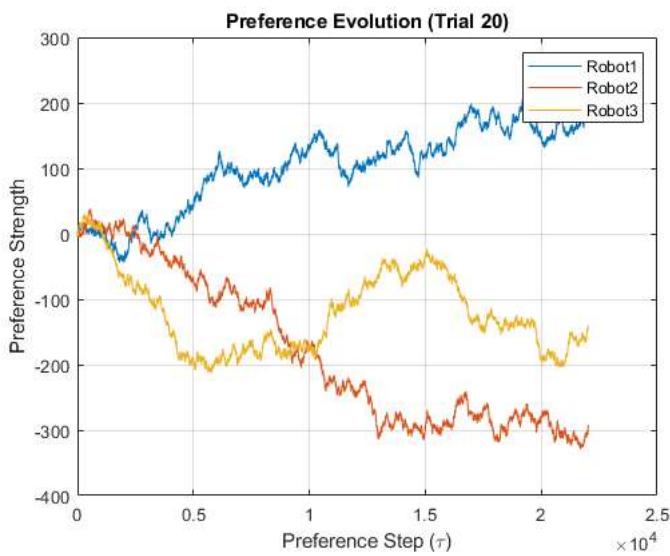
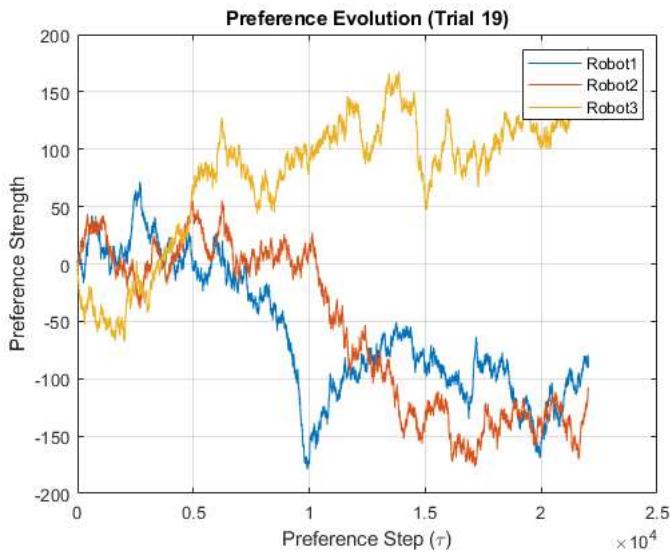


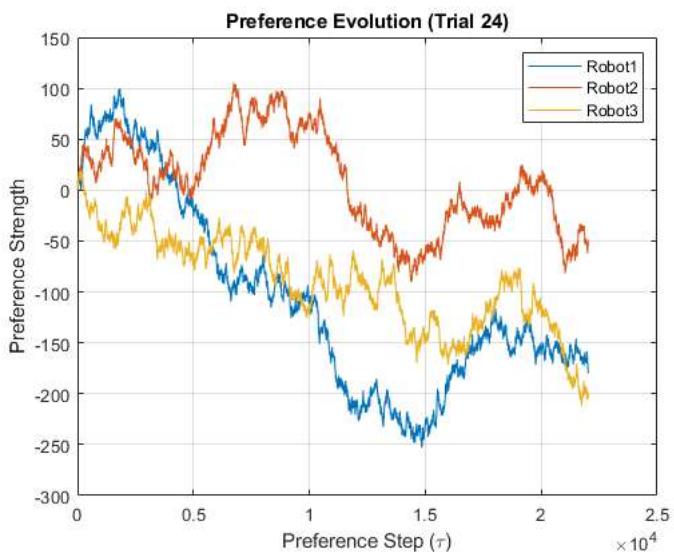
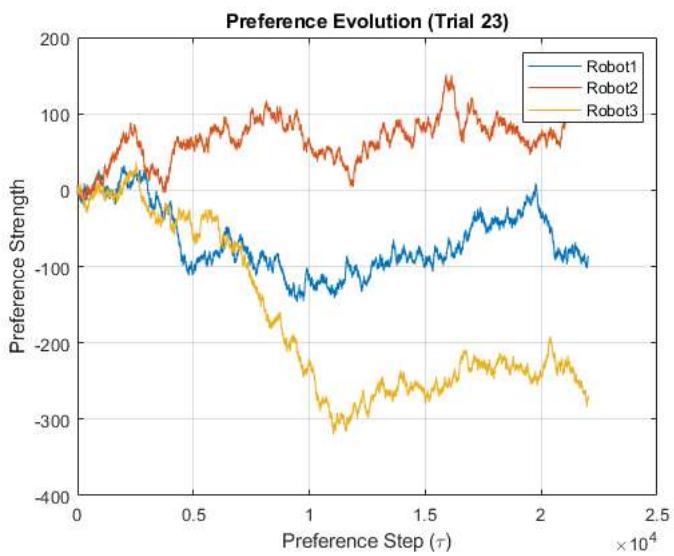
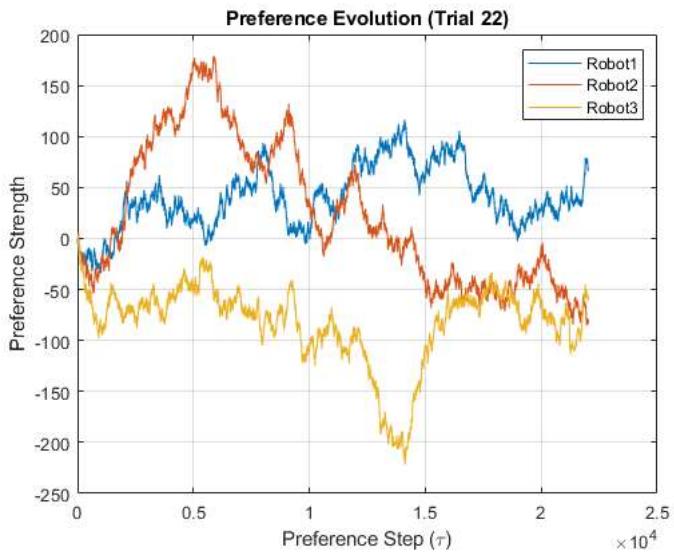


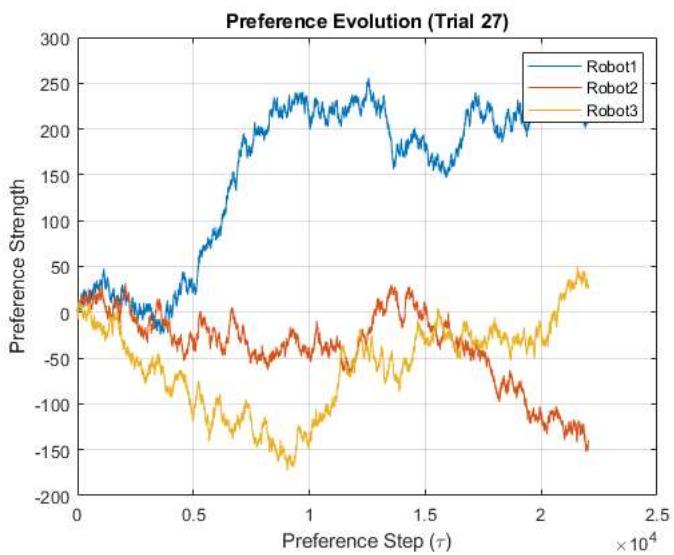
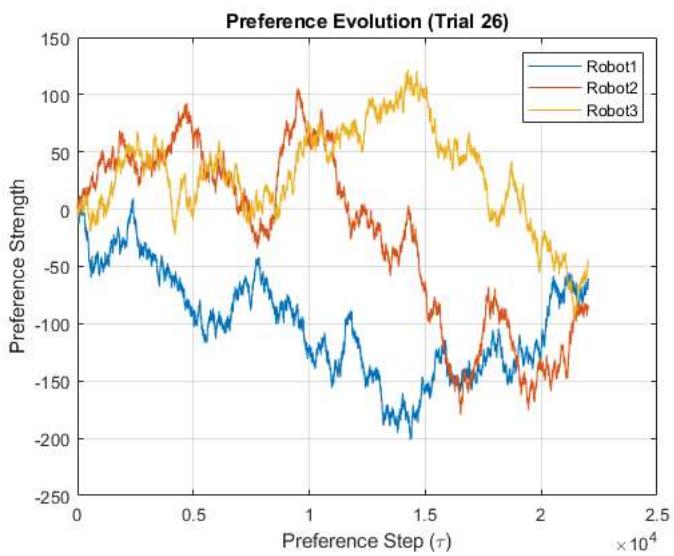
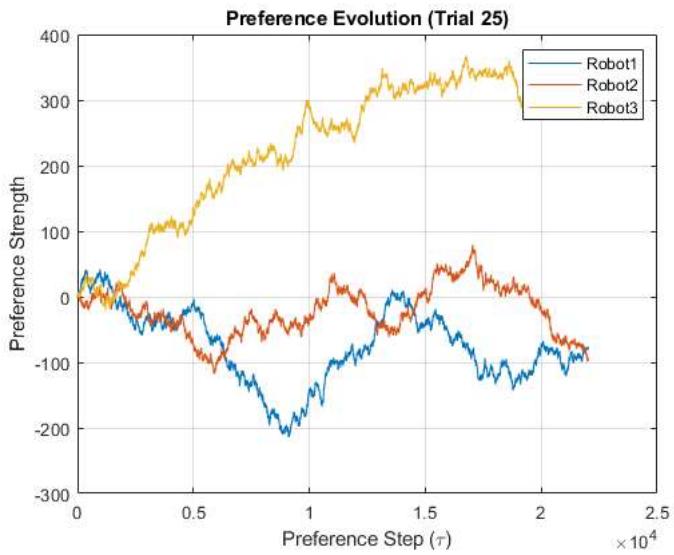


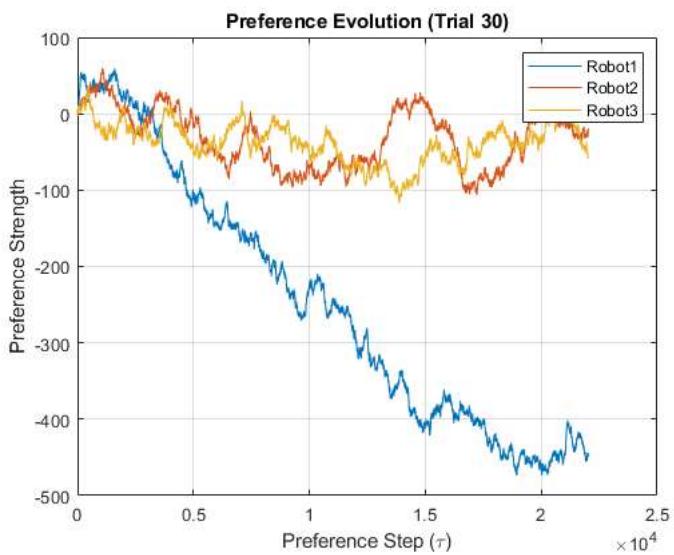
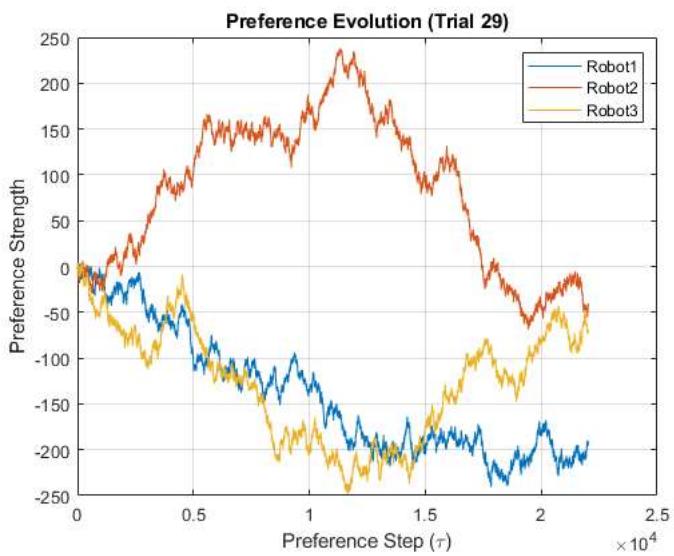
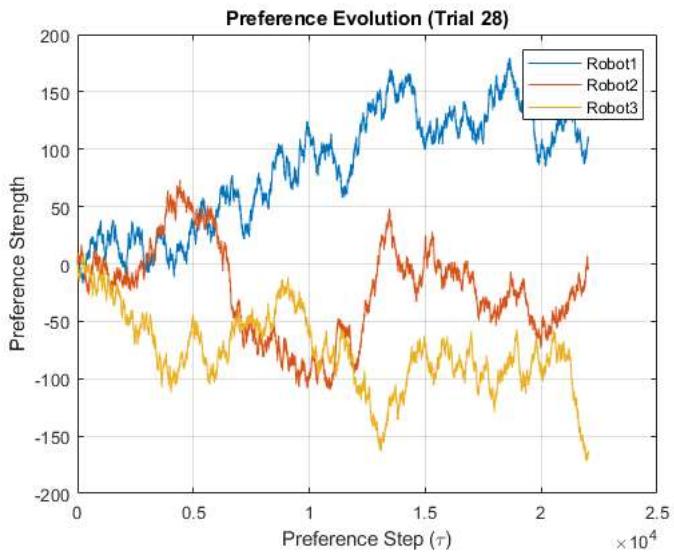


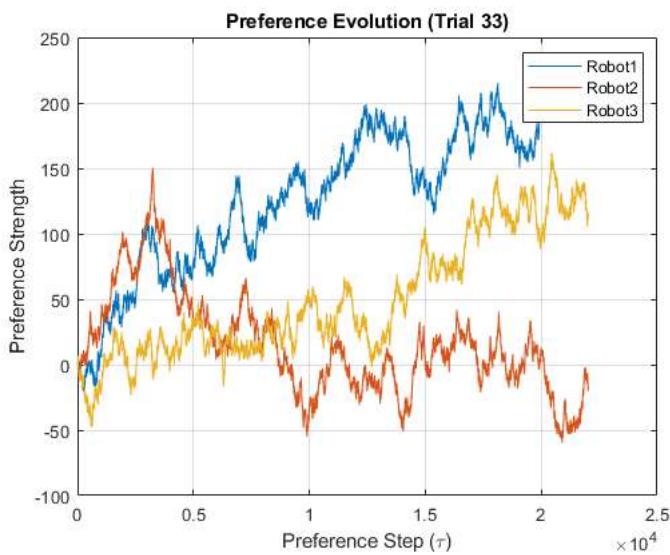
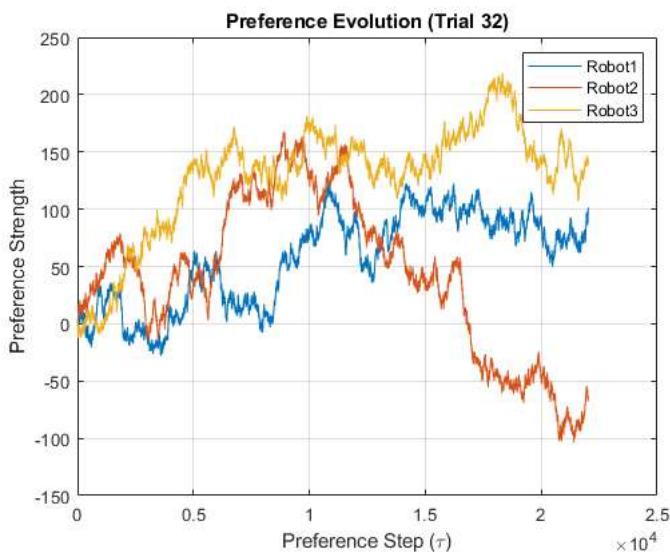
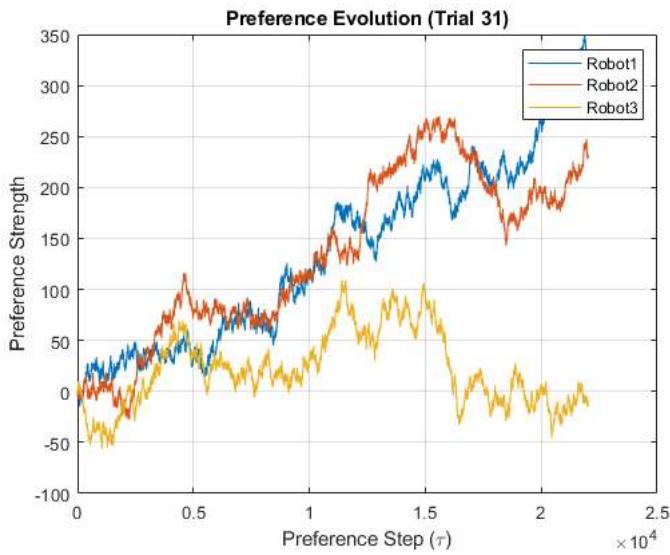


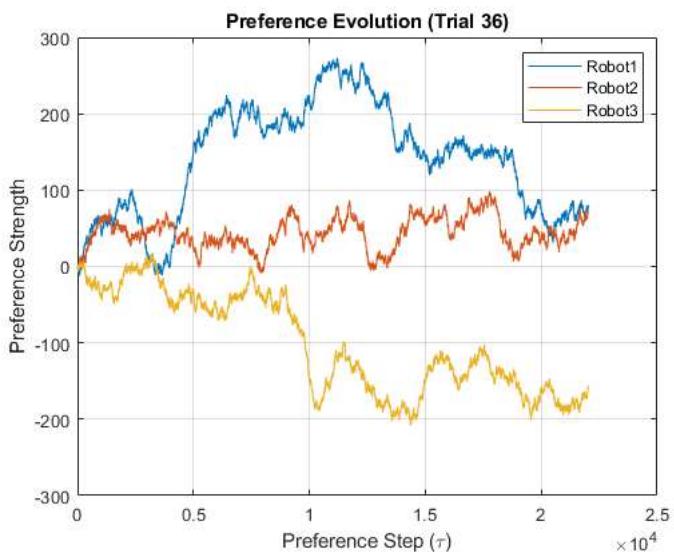
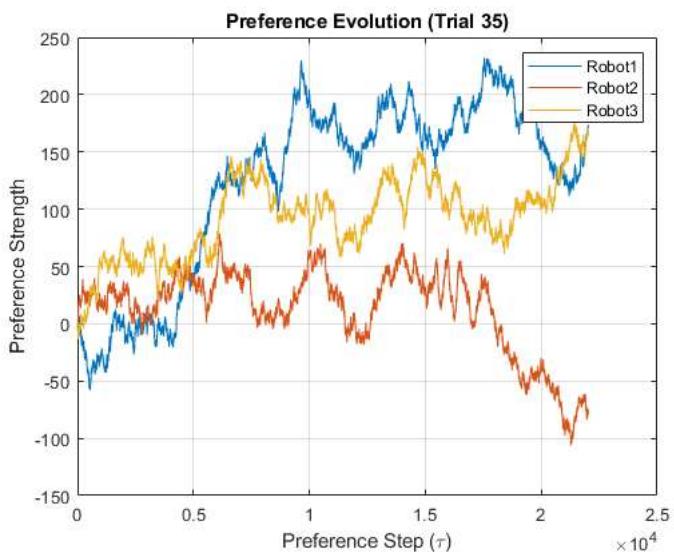
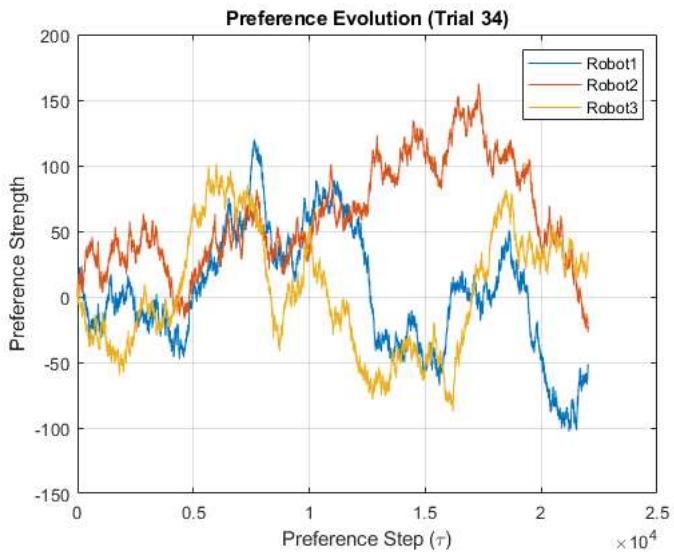


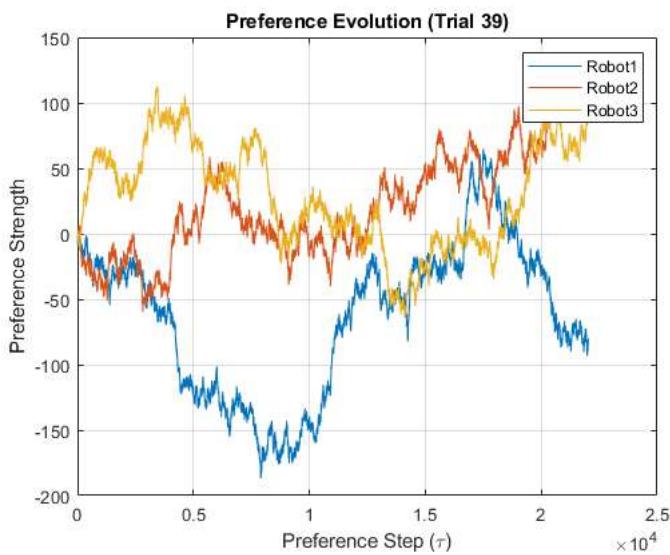
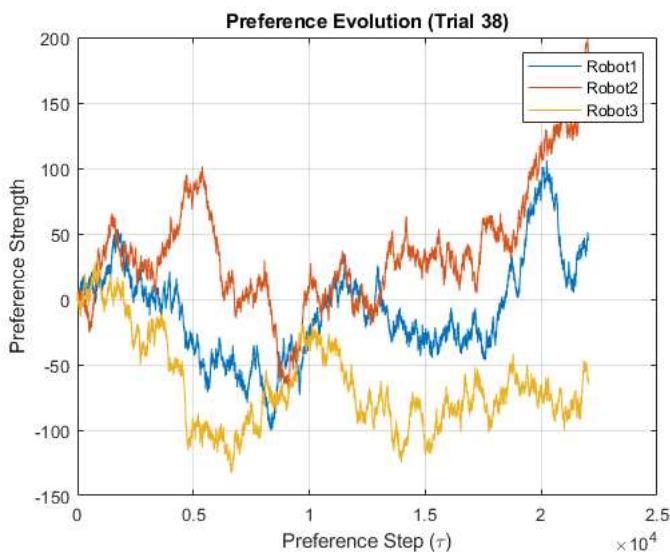
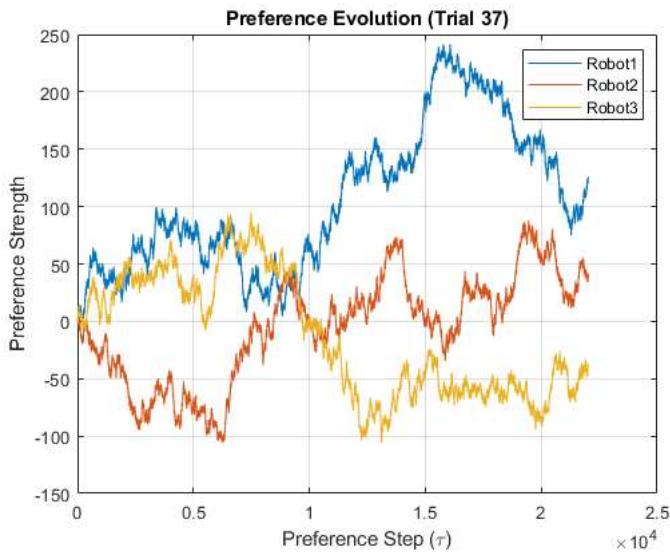


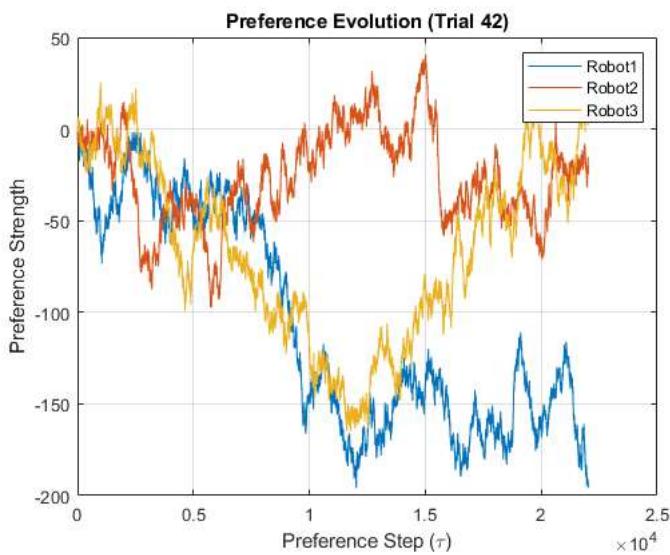
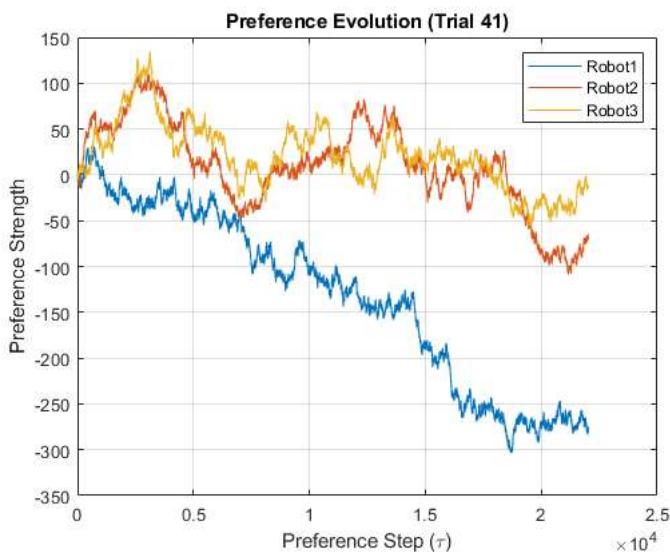
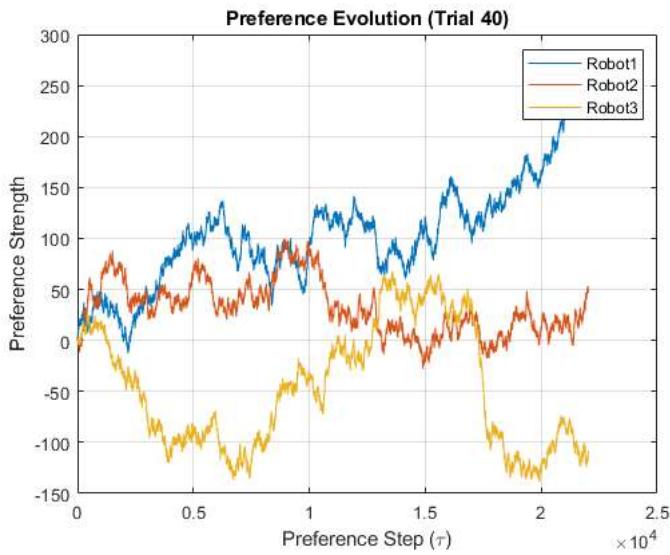


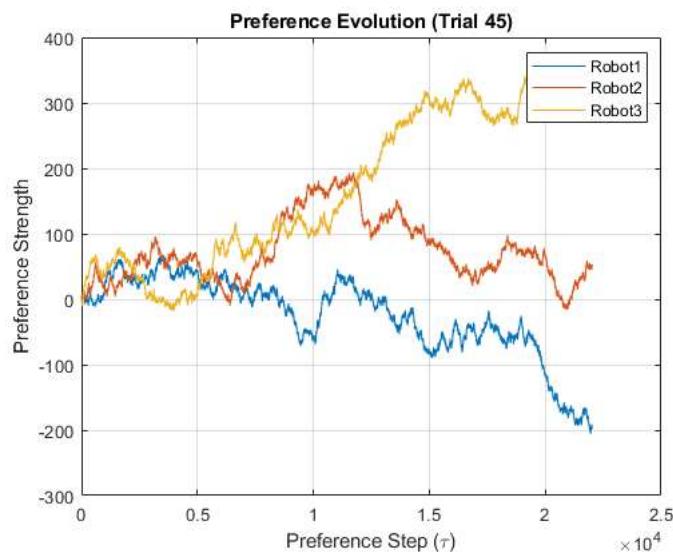
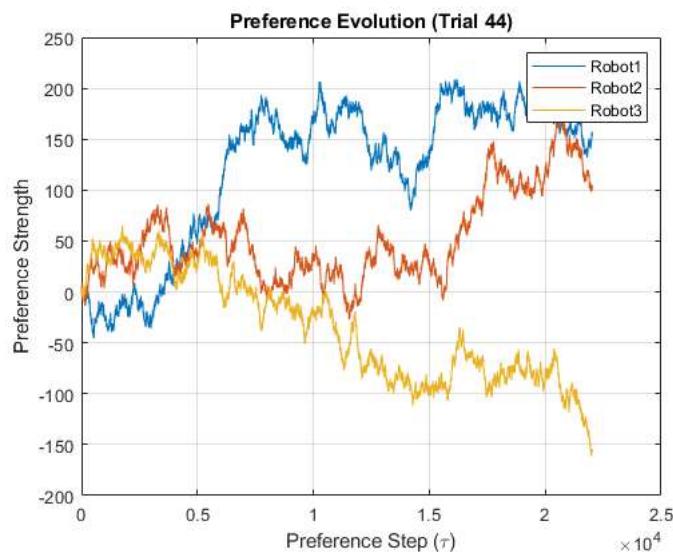
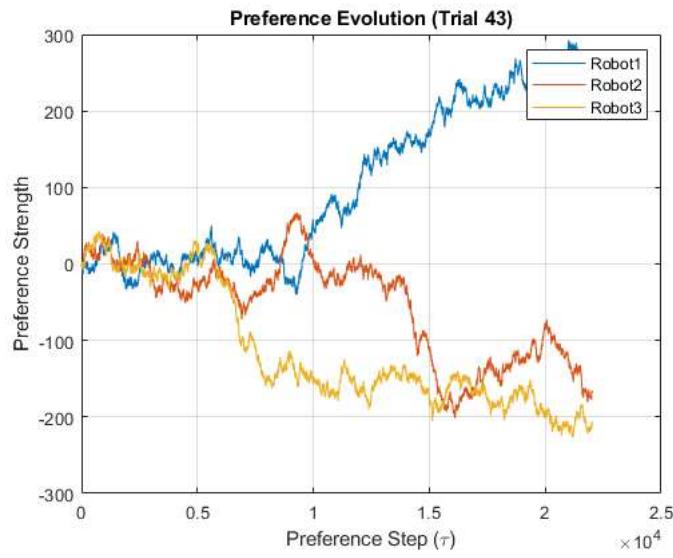


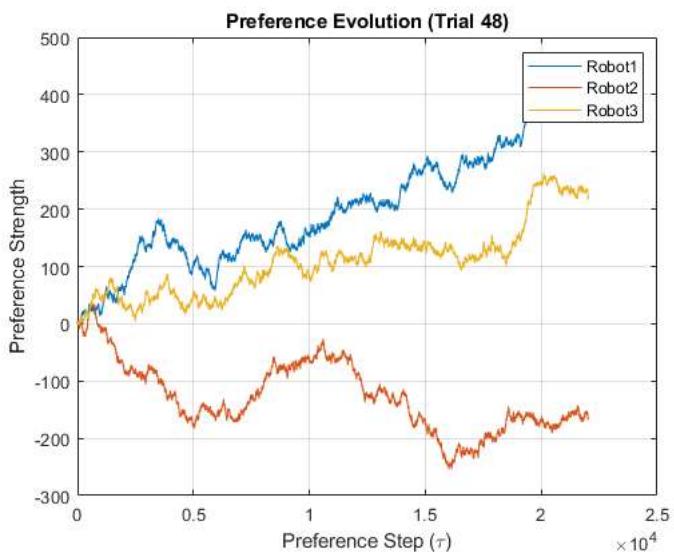
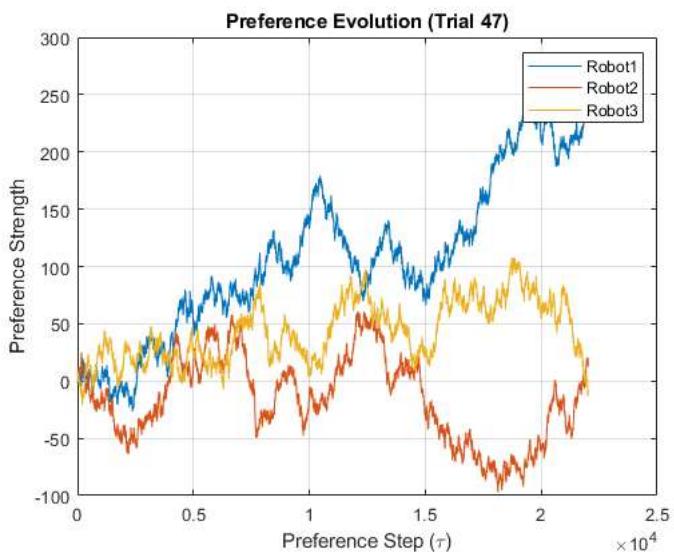
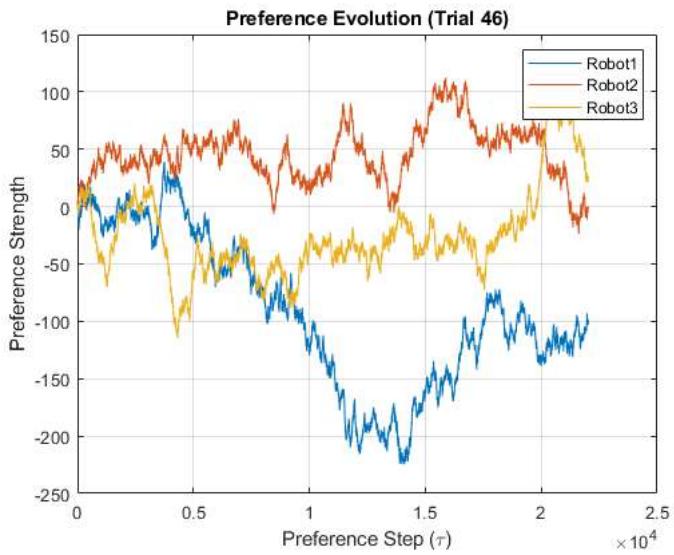


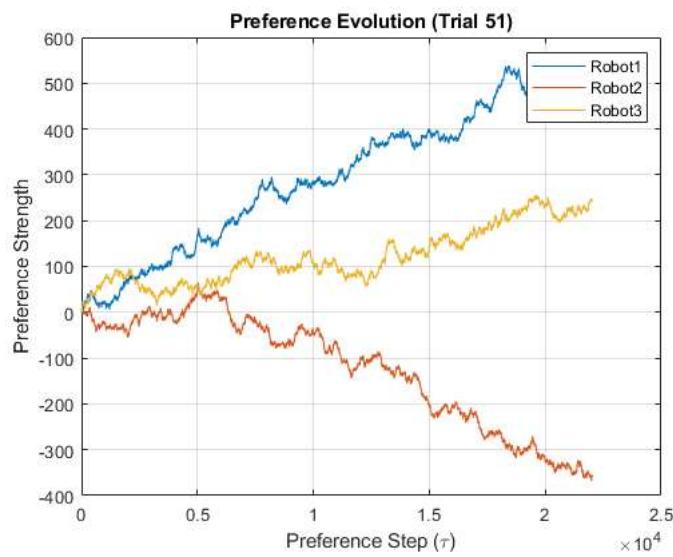
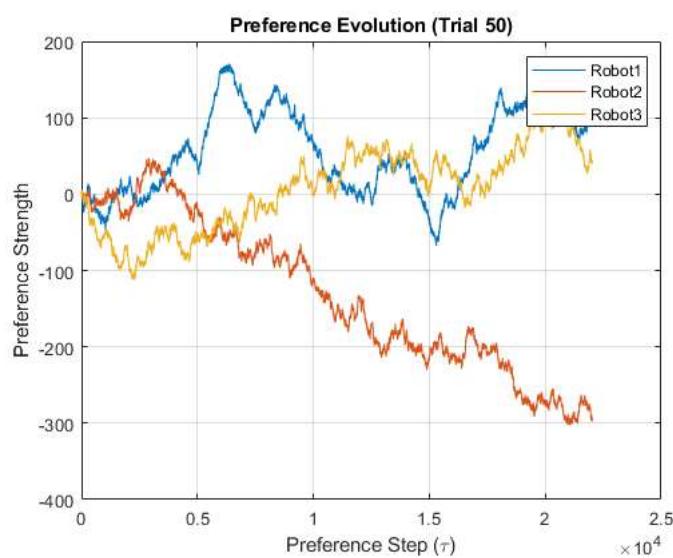
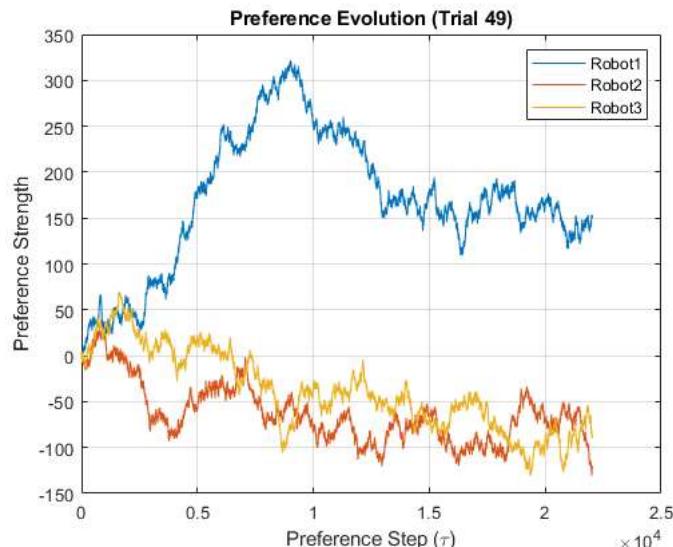












Helper Functions

```
function param = validateParam(params, name, default)
    if isfield(params, name) && isnumeric(params.(name))
        param = params.(name);
    else
        warning('Using default for %s', name);
```

```
    param = default;
end
end

function [phi1, phi2, tau, error_sd] = getFallbackParams()
    phi1 = 0.5 + 0.1*randn();
    phi2 = 0.8 + 0.1*randn();
    tau = 10 + randi(5);
    error_sd = 0.1 + 0.05*rand();
    warning('Using randomized default parameters');
end
```

```
Estimated Parameters:
phi1: 1.3524
phi2: 0
tau: 22027.4658
error_sd: 1
Initial Preferences (from ASCs):
0.0804    0.1052      0
```
