

```
In [96]: import pandas as pd
from scipy import stats
import numpy as np
from scipy.stats import wilcoxon
import seaborn as sns
import matplotlib.pyplot as plt
from statsmodels.stats.multitest import multipletests
from scipy.stats import mannwhitneyu
```

```
In [18]: df_new = pd.read_csv('Question_new.csv')
```

```
In [20]: # 1. Remove rows where Timepoint is '0'
df_cleaned = df_new[df_new['Timepoint relative to drug administration (in minutes)'] != '0']

# 2. Replace 'baseline' with 0 in the Timepoint column
df_cleaned['Timepoint relative to drug administration (in minutes)'] = df_cleaned['Timepoint relative to drug administration (in minutes)'].replace('baseline', 0)

# 3. Replace 'ms' (missing) values with NaN throughout the entire DataFrame
df_cleaned = df_cleaned.replace('ms', np.nan)

df_cleaned['Timepoint relative to drug administration (in minutes)'] = pd.to_numeric(df_cleaned['Timepoint relative to drug administration (in minutes)'])

timepoints = df_cleaned['Timepoint relative to drug administration (in minutes)'].unique()
print(timepoints)
```

```
[ 0  30  60 120 180 240 300 360]
```

C:\Users\jason han\AppData\Local\Temp\ipykernel_17632\2506174059.py:5: SettingWithCopyWarning:

A value is trying to be set on a copy of a slice from a DataFrame.

Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy

```
df_cleaned['Timepoint relative to drug administration (in minutes)'] = df_cleaned['Timepoint relative to drug administration (in minutes)'].replace('baseline', 0)
```

```
In [277...]: rating_columns = [
    '1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)',
    '2. Now-ness (0 = none to\n10 = strongest imaginable)',
    '3. Letting Go (0 = none to\n10 = strongest imaginable)',
    '4. Equanimity (0 = none to\n10 = strongest imaginable)',
    '5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)',
    '6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable)',
    '7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)',
    '8. Timelessness (0 = none to\n10 = strongest imaginable)',
    '9. Ineffability (0 = none to\n10 = strongest imaginable)',
    '10. Feelings of joy (0 = none to\n10 = strongest imaginable)',
    '11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)',
    '12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)',
    '13. Negative emotional valence (0 = none to\n10 = strongest imaginable)'
]

m = len(rating_columns)
```

```
specific_timepoints = [0, 30, 60, 120, 180, 240, 300, 360]
shortened_rating_columns = [
    '1.Psilocybin Effect', '2.Now-ness', '3.Letting Go', '4.Equanimity', '5.Pure Aw
    '6.Fusion of Self', '7.Reverence', '8.Timelessness', '9.Ineffability',
    '10.Feelings of Joy', '11.Peace & Tranquility', '12.Positive Emotional Valence'
]
```

```
In [24]: df_cleaned.columns = df_cleaned.columns.str.strip()
#print(df_filtered.columns)

df_cleaned[rating_columns] = df_cleaned[rating_columns].apply(pd.to_numeric, errors='coerce')

# Check if the conversion worked by printing the dtypes
#print(df_filtered[rating_columns].dtypes)
```

Checking NA in df_cleaned

Q4 has 10 missing but it wasn't a reason why

```
In [26]: for timepoint in timepoints:
    df_timepoint = df_cleaned[df_cleaned['Timepoint relative to drug administration'] == timepoint]
    print(f"Missing values for Timepoint {timepoint} (minutes):")
    print(df_timepoint[rating_columns].isna().sum())
total_missing_values = df_cleaned[rating_columns].isna().sum()
print("Total missing values across all time points for each question:")
print(total_missing_values)
```

Missing values for Timepoint 0 (minutes):

1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
0
 2. Now-ness (0 = none to\n10 = strongest imaginable)
0
 3. Letting Go (0 = none to\n10 = strongest imaginable)
0
 4. Equanimity (0 = none to\n10 = strongest imaginable)
0
 5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
0
 6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable)
0
 7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
0
 8. Timelessness (0 = none to\n10 = strongest imaginable)
0
 9. Ineffability (0 = none to\n10 = strongest imaginable)
0
 10. Feelings of joy (0 = none to\n10 = strongest imaginable)
0
 11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
0
 12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
0
 13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
0
- dtype: int64
- Missing values for Timepoint 30 (minutes):
1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
0
 2. Now-ness (0 = none to\n10 = strongest imaginable)
0
 3. Letting Go (0 = none to\n10 = strongest imaginable)
0
 4. Equanimity (0 = none to\n10 = strongest imaginable)
0
 5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
0
 6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable)
0
 7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
0
 8. Timelessness (0 = none to\n10 = strongest imaginable)
0
 9. Ineffability (0 = none to\n10 = strongest imaginable)
0
 10. Feelings of joy (0 = none to\n10 = strongest imaginable)
0
 11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
0
 12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
0
 13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
0
- dtype: int64

Missing values for Timepoint 60 (minutes):

1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
1
 2. Now-ness (0 = none to\n10 = strongest imaginable)
1
 3. Letting Go (0 = none to\n10 = strongest imaginable)
1
 4. Equanimity (0 = none to\n10 = strongest imaginable)
2
 5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
1
 6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable) 2
 7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
2
 8. Timelessness (0 = none to\n10 = strongest imaginable)
3
 9. Ineffability (0 = none to\n10 = strongest imaginable)
3
 10. Feelings of joy (0 = none to\n10 = strongest imaginable)
3
 11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
3
 12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
3
 13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
3
- dtype: int64

Missing values for Timepoint 120 (minutes):

1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
2
 2. Now-ness (0 = none to\n10 = strongest imaginable)
2
 3. Letting Go (0 = none to\n10 = strongest imaginable)
2
 4. Equanimity (0 = none to\n10 = strongest imaginable)
3
 5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
3
 6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable) 3
 7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
3
 8. Timelessness (0 = none to\n10 = strongest imaginable)
3
 9. Ineffability (0 = none to\n10 = strongest imaginable)
3
 10. Feelings of joy (0 = none to\n10 = strongest imaginable)
3
 11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
4
 12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
3
 13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
3
- dtype: int64

Missing values for Timepoint 180 (minutes):

1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
1
 2. Now-ness (0 = none to\n10 = strongest imaginable)
3
 3. Letting Go (0 = none to\n10 = strongest imaginable)
2
 4. Equanimity (0 = none to\n10 = strongest imaginable)
2
 5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
2
 6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable) 2
 7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
2
 8. Timelessness (0 = none to\n10 = strongest imaginable)
2
 9. Ineffability (0 = none to\n10 = strongest imaginable)
2
 10. Feelings of joy (0 = none to\n10 = strongest imaginable)
2
 11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
3
 12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
2
 13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
2
- dtype: int64

Missing values for Timepoint 240 (minutes):

1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
1
 2. Now-ness (0 = none to\n10 = strongest imaginable)
1
 3. Letting Go (0 = none to\n10 = strongest imaginable)
1
 4. Equanimity (0 = none to\n10 = strongest imaginable)
1
 5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
1
 6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable) 2
 7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
1
 8. Timelessness (0 = none to\n10 = strongest imaginable)
1
 9. Ineffability (0 = none to\n10 = strongest imaginable)
2
 10. Feelings of joy (0 = none to\n10 = strongest imaginable)
1
 11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
2
 12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
2
 13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
2
- dtype: int64

Missing values for Timepoint 300 (minutes):

1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
1
2. Now-ness (0 = none to\n10 = strongest imaginable)
1
3. Letting Go (0 = none to\n10 = strongest imaginable)
3
4. Equanimity (0 = none to\n10 = strongest imaginable)
2
5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
3
6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable) 2
7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
2
8. Timelessness (0 = none to\n10 = strongest imaginable)
2
9. Ineffability (0 = none to\n10 = strongest imaginable)
2
10. Feelings of joy (0 = none to\n10 = strongest imaginable)
2
11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
3
12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
3
13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
3

dtype: int64

Missing values for Timepoint 360 (minutes):

1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
0
2. Now-ness (0 = none to\n10 = strongest imaginable)
0
3. Letting Go (0 = none to\n10 = strongest imaginable)
0
4. Equanimity (0 = none to\n10 = strongest imaginable)
0
5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
0
6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable) 0
7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
0
8. Timelessness (0 = none to\n10 = strongest imaginable)
0
9. Ineffability (0 = none to\n10 = strongest imaginable)
0
10. Feelings of joy (0 = none to\n10 = strongest imaginable)
0
11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
0
12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
0
13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
0

dtype: int64

```
Total missing values across all time points for each question:
1. Overall Psilocybin Effect (0 = none to\n10 = strongest imaginable)
6
2. Now-ness (0 = none to\n10 = strongest imaginable)
8
3. Letting Go (0 = none to\n10 = strongest imaginable)
9
4. Equanimity (0 = none to\n10 = strongest imaginable)
10
5. Pure being and pure awareness (0 = none to\n10 = strongest imaginable)
10
6. Fusion of your personal self into a larger whole (0 = none to\n10 = strongest imaginable) 11
7. Sense of reverence or sacredness (0 = none to\n10 = strongest imaginable)
10
8. Timelessness (0 = none to\n10 = strongest imaginable)
11
9. Ineffability (0 = none to\n10 = strongest imaginable)
12
10. Feelings of joy (0 = none to\n10 = strongest imaginable)
11
11. Feelings of peace and tranquility (0 = none to\n10 = strongest imaginable)
15
12. Positive Emotional Valence (0 = none to\n10 = strongest imaginable)
13
13. Negative emotional valence (0 = none to\n10 = strongest imaginable)
13
dtype: int64
```

Sections for Pair T Test

```
In [275...]: paired_results_by_time = {}

for timepoint in timepoints:
    df_timepoint = df_cleaned[df_cleaned['Timepoint relative to drug administration']
    placebo_scores = df_timepoint[df_timepoint['Condition (PLA: placebo, EXP: 25 mg
    exp_scores = df_timepoint[df_timepoint['Condition (PLA: placebo, EXP: 25 mg/70
    paired_results_by_time[timepoint] = {}

    raw_p_values = []
    t_stats = []
    for col in rating_columns:
        if len(placebo_scores[col]) == len(exp_scores[col]) and len(placebo_scores[
            t_stat, p_value = stats.ttest_rel(placebo_scores[col], exp_scores[col],
            raw_p_values.append(p_value)
            t_stats.append(t_stat)
        else:
            raw_p_values.append(np.nan)
            t_stats.append(None)

    valid_mask = ~np.isnan(raw_p_values)
    adjusted_p_values = np.full(len(raw_p_values), np.nan)
    if valid_mask.any():
        adjusted_p_values[valid_mask] = multipletests(np.array(raw_p_values)[valid_
```

```
for col, t_stat, adj_p_value in zip(rating_columns, t_stats, adjusted_p_values)
    paired_results_by_time[timepoint][col] = (t_stat, adj_p_value)

print(f"Results for Timepoint {timepoint} (minutes):")
for col, (t_stat, adj_p_value) in paired_results_by_time[timepoint].items():
    print(f"{col}: T-statistic = {t_stat}, Bonferroni-Holm Adjusted P-value = {adj_p_value:.4f}")
    print("\n")
```

Results for Timepoint 0 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = nan, Bonferroni-Holm Adjusted P-value = na
n
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.18797789509922808, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.7056967961720457, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.9687189593929654, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.6913837373523726, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.657595949221429, Bonferroni-Holm Adjusted P-value = 1.0
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.10347288589592778, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.8154100913168026, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 1.2403473458920846, Bonferroni-Holm Adjusted P-value = 1.0
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.7096457724119537, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.26126497213658206, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.4908806936738159, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 1.698999098923931, Bonferroni-Holm Adjusted P-value = 1.0

Results for Timepoint 30 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.568797893963764, Bonferroni-Holm Adjusted P-value = 0.024995127769544035
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.6095219666786235, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.3485075176786614, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.12299834568337575, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$

10 = strongest imaginable): T-statistic = 0.13411044519645504, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = 1.0458250331675942, Bonferroni-Holm Adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = 0.14637194260221537, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -0.6218845001217771, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -2.3196933857945083, Bonferroni-Holm Adjusted P-value = 0.3726197266980799
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = -0.18458480505051497, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = 1.5579423821243894, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = 0.4179383795285729, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = -0.4278625498405581, Bonferroni-Holm Adjusted P-value = 1.0

Results for Timepoint 60 (minutes):

1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): T-statistic = -7.319986682297554, Bonferroni-Holm Adjusted P-value = 7.941433212235642e-06
2. Now-ness (0 = none to
10 = strongest imaginable): T-statistic = -0.8039020483873397, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go (0 = none to
10 = strongest imaginable): T-statistic = -0.2756197330161589, Bonferroni-Holm Adjusted P-value = 1.0
4. EQUANIMITY (0 = none to
10 = strongest imaginable): T-statistic = 1.1093162417777198, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): T-statistic = -1.0062873929698608, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = -2.7635216651841996, Bonferroni-Holm Adjusted P-value = 0.12797534815970474
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = 0.2802935969389348, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -1.2292725943057183, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -4.406696305852698, Bonferroni-Holm Adjusted P-value = 0.00462725011468742

10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -0.7026008204419223, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = 3.1438385661850643, Bonferroni-Holm Adjusted P-value = 0.06512884823596579
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -0.20070964149630047, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -1.5312829869775526, Bonferroni-Holm Adjusted P-value = 1.0

Results for Timepoint 120 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -10.932119067896782, Bonferroni-Holm Adjusted P-value = 1.5982736989530253e-08
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -5.569933086615312, Bonferroni-Holm Adjusted P-value = 0.00020363960144092612
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -2.48305515724224, Bonferroni-Holm Adjusted P-value = 0.11265077434946877
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = 0.0, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -4.2653445539189185, Bonferroni-Holm Adjusted P-value = 0.003345030601038642
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -6.362252814024701, Bonferroni-Holm Adjusted P-value = 4.616440843908374e-05
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -3.510319506473832, Bonferroni-Holm Adjusted P-value = 0.01637926738571975
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -6.272727272727273, Bonferroni-Holm Adjusted P-value = 5.056678983305835e-05
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -7.0141826155279965, Bonferroni-Holm Adjusted P-value = 1.3382786779286471e-05
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -3.1891395762619132, Bonferroni-Holm Adjusted P-value = 0.02898201565579789
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -0.48743450538846206, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -1.7331773447985919, Bonferroni-Holm Adjusted P-value = 0.39705504372942685
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -1.0566747075571858, Bonferroni-Holm Adjusted P-value = 0.9117333693810261

Results for Timepoint 180 (minutes):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -16.92254051915307, Bonferroni-Holm Adjusted P-value = 3.3192209959821655e-12
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -9.093305161368113, Bonferroni-Holm Adjusted P-value = 4.1539714721539984e-07
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -7.416493535870903, Bonferroni-Holm Adjusted P-value = 4.052179921368822e-06
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -6.454972243679028, Bonferroni-Holm Adjusted P-value = 2.0783000782618142e-05
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -8.93519466806411, Bonferroni-Holm Adjusted P-value = 3.7495739364514586e-07
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -7.777210863692854, Bonferroni-Holm Adjusted P-value = 2.5137842252690255e-06
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -7.284844920603416, Bonferroni-Holm Adjusted P-value = 4.579460872973615e-06
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -5.687824834798567, Bonferroni-Holm Adjusted P-value = 5.4621263852816275e-05
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -7.783316947258129, Bonferroni-Holm Adjusted P-value = 2.5137842252690255e-06
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -6.185760537730083, Bonferroni-Holm Adjusted P-value = 3.033232630714011e-05
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.5593176062786935, Bonferroni-Holm Adjusted P-value = 0.03942357609080632
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -5.803639343821998, Bonferroni-Holm Adjusted P-value = 5.4621263852816275e-05
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.5784790097963374, Bonferroni-Holm Adjusted P-value = 0.5697350293264853

Results for Timepoint 240 (minutes):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -12.261208713114476, Bonferroni-Holm Adjusted P-value = 2.339209948600327e-09
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -6.167072032845844, Bonferroni-Holm Adjusted P-value = 5.047457435197467e-05
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -7.377378401994856, Bonferroni-Holm Adjusted P-value = 6.556753136058579e-06
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.559343516304476, Bonferroni-Holm Adjusted P-value = 0.03834998319355058
5. Pure being and pure awareness ($\theta = \text{none to}$

10 = strongest imaginable): T-statistic = -6.307640191571234, Bonferroni-Holm Adjusted P-value = 4.231407792605709e-05
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = -5.832660825504768, Bonferroni-Holm Adjusted P-value = 8.981774094417358e-05
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = -4.520967182069254, Bonferroni-Holm Adjusted P-value = 0.0007013845997326975
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -6.74630238263132, Bonferroni-Holm Adjusted P-value = 1.9092684139645698e-05
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -7.279943591298901, Bonferroni-Holm Adjusted P-value = 7.265501320462914e-06
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = -5.156104408169628, Bonferroni-Holm Adjusted P-value = 0.00033699352054063046
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = -4.924091613757983, Bonferroni-Holm Adjusted P-value = 0.00047103883331066126
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = -4.720808303895489, Bonferroni-Holm Adjusted P-value = 0.0005950860359978547
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = 0.7205037703302525, Bonferroni-Holm Adjusted P-value = 0.4799862479446819

Results for Timepoint 300 (minutes):

1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): T-statistic = -7.127537641337663, Bonferroni-Holm Adjusted P-value = 8.598097648810624e-06
2. Now-ness (0 = none to
10 = strongest imaginable): T-statistic = -5.562213147927255, Bonferroni-Holm Adjusted P-value = 0.00022977961918677748
3. Letting Go (0 = none to
10 = strongest imaginable): T-statistic = -4.066886812455412, Bonferroni-Holm Adjusted P-value = 0.0032882059862329293
4. Equanimity (0 = none to
10 = strongest imaginable): T-statistic = -3.8848299473609478, Bonferroni-Holm Adjusted P-value = 0.0039870116018123365
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): T-statistic = -5.293714326561026, Bonferroni-Holm Adjusted P-value = 0.0004142872307212161
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = -4.584506420002511, Bonferroni-Holm Adjusted P-value = 0.0015272130793118812
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = -4.3233154997720336, Bonferroni-Holm Adjusted P-value = 0.002198360139427233
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -5.378249582661413, Bonferroni-Holm Adjusted P-value = 0.00037837324058654135
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -4.61043509420293, Bonferroni-Holm Adjusted P-value = 0.0015272130793118812

10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.99883254853061, Bonferroni-Holm Adjusted P-value = 0.0007173653984728906
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.0, Bonferroni-Holm Adjusted P-value = 0.014723448367737278
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.4719564436457055, Bonferroni-Holm Adjusted P-value = 0.007658018784096051
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -1.0988733765976275, Bonferroni-Holm Adjusted P-value = 0.28555325143985166

Results for Timepoint 360 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -5.971631046748498, Bonferroni-Holm Adjusted P-value = 0.00010022264478978498
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.8729833462074166, Bonferroni-Holm Adjusted P-value = 0.005680024912537183
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.768316485434158, Bonferroni-Holm Adjusted P-value = 0.0011729978653074223
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -5.152135733635232, Bonferroni-Holm Adjusted P-value = 0.000533446489064515
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.3921747176506836, Bonferroni-Holm Adjusted P-value = 0.008989749178792965
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.5976931812503268, Bonferroni-Holm Adjusted P-value = 0.008989749178792965
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.690415759823429, Bonferroni-Holm Adjusted P-value = 0.0012645980047571086
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.0571550015261115, Bonferroni-Holm Adjusted P-value = 0.004924069193392762
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -5.4707703865093915, Bonferroni-Holm Adjusted P-value = 0.0002822705327416296
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.534578227065181, Bonferroni-Holm Adjusted P-value = 0.008989749178792965
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.4230670981304208, Bonferroni-Holm Adjusted P-value = 0.050005222129960954
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.952847075210474, Bonferroni-Holm Adjusted P-value = 0.005498592228056786
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.5071831293409736, Bonferroni-Holm Adjusted P-value = 0.6175731497295256

```
In [281...]
timepoints = list(paired_results_by_time.keys())
t_stats_by_question = {col: [] for col in rating_columns}
p_values_by_question = {col: [] for col in rating_columns}

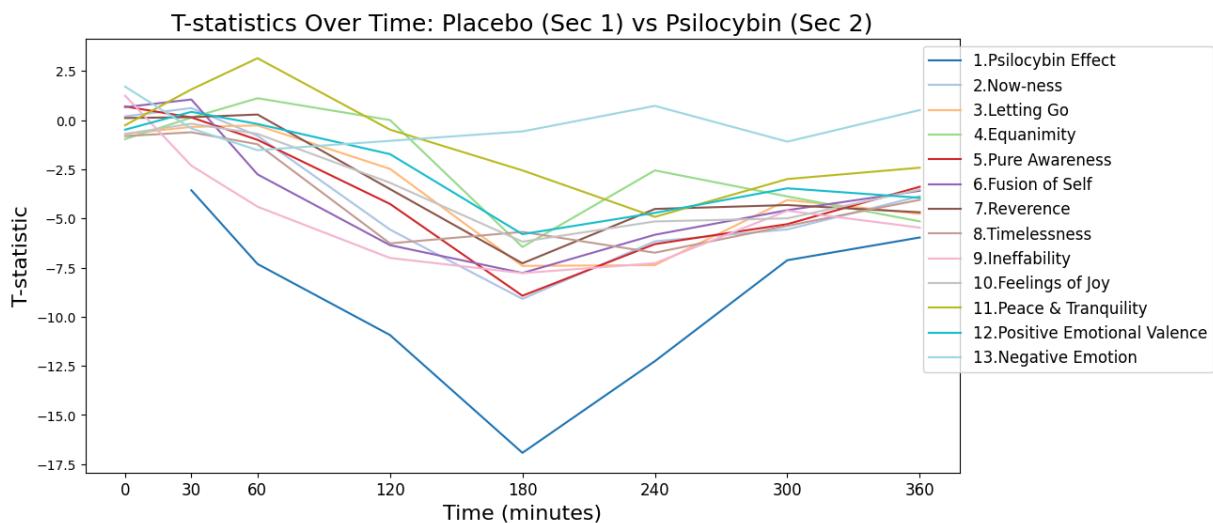
for timepoint in timepoints:
    for col in rating_columns:
        t_stat, p_value = paired_results_by_time[timepoint][col]
        t_stats_by_question[col].append(t_stat)
        p_values_by_question[col].append(p_value)

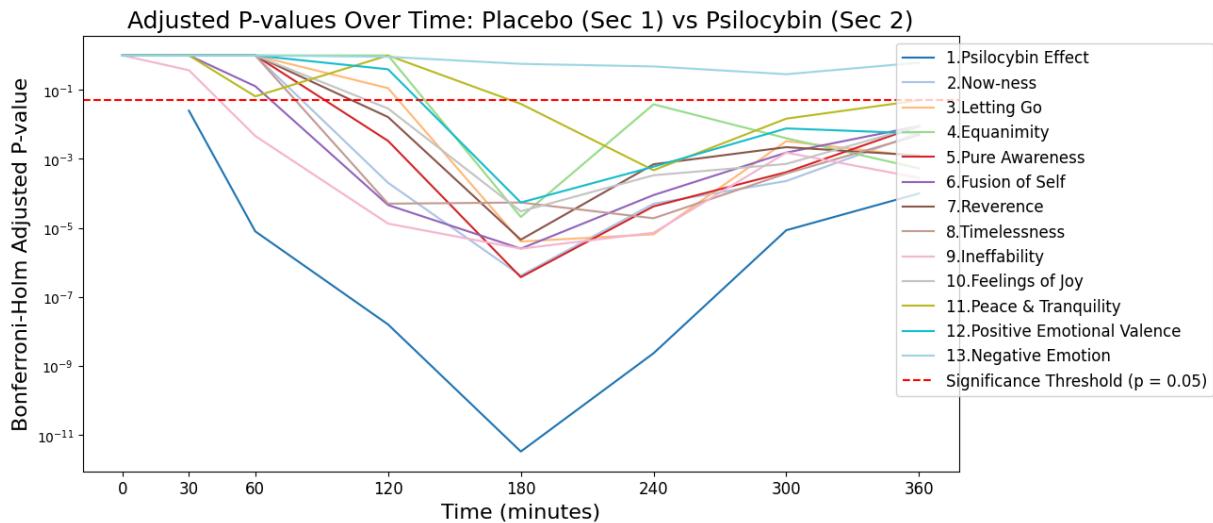
# Plot T-statistics over time
plt.figure(figsize=(12, 6))
cmap = plt.get_cmap('tab20', len(shortened_rating_columns))

for i, (col, short_col) in enumerate(zip(rating_columns, shortened_rating_columns)):
    plt.plot(timepoints, t_stats_by_question[col], label=short_col, color=cmap(i))
plt.xlabel('Time (minutes)', fontsize=16)
plt.ylabel('T-statistic', fontsize=16)
plt.title('T-statistics Over Time: Placebo (Sec 1) vs Psilocybin (Sec 2)', fontsize=12)
plt.xticks(timepoints, [0, 30, 60, 120, 180, 240, 300, 360], fontsize=12)
plt.legend(loc='upper right', bbox_to_anchor=(1.3, 1), fontsize=12)
plt.show()

# Plot Bonferroni-Holm Adjusted P-values over time
plt.figure(figsize=(12, 6))

for i, (col, short_col) in enumerate(zip(rating_columns, shortened_rating_columns)):
    plt.plot(timepoints, p_values_by_question[col], label=short_col, color=cmap(i))
plt.xlabel('Time (minutes)', fontsize=16)
plt.ylabel('Bonferroni-Holm Adjusted P-value', fontsize=16)
plt.title('Adjusted P-values Over Time: Placebo (Sec 1) vs Psilocybin (Sec 2)', font
plt.axhline(y=0.05, color='r', linestyle='--', label='Significance Threshold (p = 0
plt.xticks(timepoints, [0, 30, 60, 120, 180, 240, 300, 360], fontsize=12)
plt.yscale('log')
plt.legend(loc='upper right', bbox_to_anchor=(1.3, 1), fontsize=12)
plt.show()
```





This Section is for Wilcoxon

Wilcoxon is not good with NaN

```
In [41]: df_cleaned_imputed = df_cleaned.copy()

imputation_summary = {col: {'count_before': 0, 'sum_before': 0, 'sum_after': 0, 'imputed_count': 0} for col in df_cleaned_imputed.columns}

if all(col in df_cleaned_imputed.columns for col in rating_columns):
    for col in rating_columns:
        missing_before = df_cleaned_imputed[col].isnull()
        imputation_summary[col]['count_before'] = missing_before.sum()
        imputation_summary[col]['sum_before'] = df_cleaned_imputed[col].sum(skipna=True)
        df_cleaned_imputed[rating_columns] = df_cleaned_imputed[rating_columns].interpolate()
    for col in rating_columns:
        missing_after = df_cleaned_imputed[col].isnull()
        imputation_summary[col]['sum_after'] = df_cleaned_imputed[col].sum(skipna=True)
        imputation_summary[col]['imputed_count'] = imputation_summary[col]['count_b

    print("Imputation Summary:")
    for question, stats in imputation_summary.items():
        count_diff = stats['imputed_count']
        sum_diff = stats['sum_after'] - stats['sum_before']
        print(f"{question}: Imputed Count = {count_diff}, Sum Before = {stats['sum_}

else:
    print("Some columns in rating_columns are not found in the DataFrame.")
```

Imputation Summary:

1. Overall Psilocybin Effect ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 6, Sum Before = 1748.0, Sum After = 1793.5, Increase in Sum = 45.5

2. Now-ness ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 8, Sum Before = 3130.0, Sum After = 3196.5, Increase in Sum = 66.5

3. Letting Go ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 9, Sum Before = 3209.0, Sum After = 3284.0, Increase in Sum = 75.0

4. Equanimity ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 10, Sum Before = 3168.0, Sum After = 3228.0, Increase in Sum = 60.0

5. Pure being and pure awareness ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 10, Sum Before = 2573.0, Sum After = 2645.0, Increase in Sum = 72.0

6. Fusion of your personal self into a larger whole ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 11, Sum Before = 2352.0, Sum After = 2423.5, Increase in Sum = 71.5

7. Sense of reverence or sacredness ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 10, Sum Before = 2780.0, Sum After = 2837.5, Increase in Sum = 57.5

8. Timelessness ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 11, Sum Before = 2612.0, Sum After = 2692.5, Increase in Sum = 80.5

9. Ineffability ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 12, Sum Before = 2320.0, Sum After = 2392.5, Increase in Sum = 72.5

10. Feelings of joy ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 11, Sum Before = 2804.0, Sum After = 2871.5, Increase in Sum = 67.5

11. Feelings of peace and tranquility ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 15, Sum Before = 2943.0, Sum After = 3047.0, Increase in Sum = 104.0

12. Positive Emotional Valence ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 13, Sum Before = 3138.0, Sum After = 3211.0, Increase in Sum = 73.0

13. Negative emotional valence ($\theta = \text{none to } 10 = \text{strongest imaginable}$): Imputed Count = 13, Sum Before = 659.0, Sum After = 671.0, Increase in Sum = 12.0

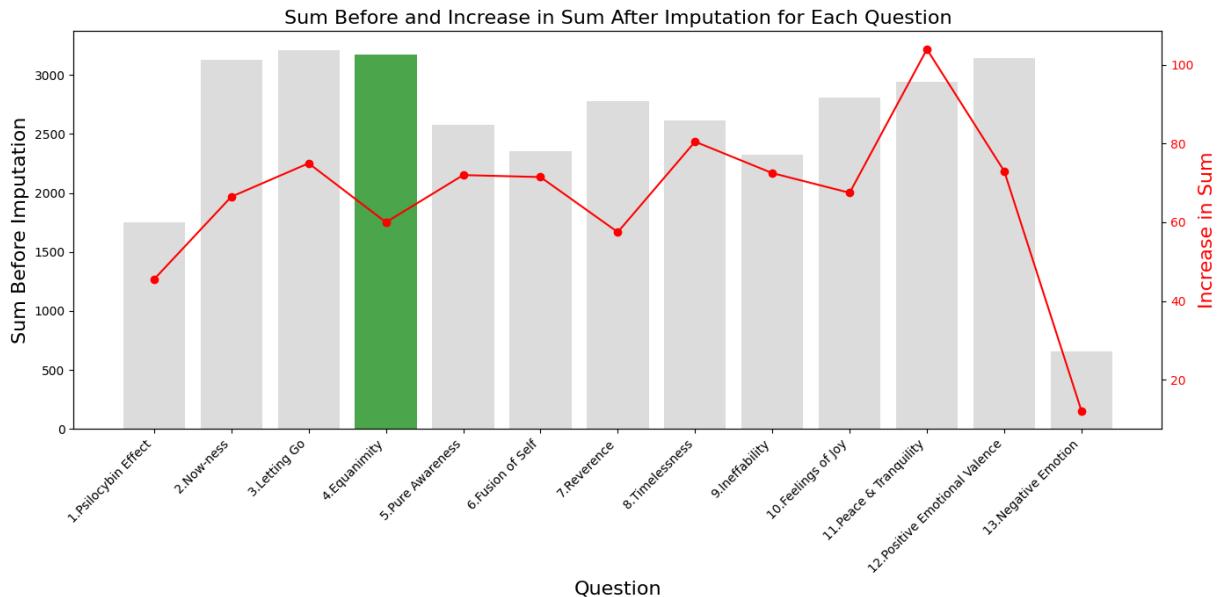
```
In [43]: questions = shortened_rating_columns
sum_before = [imputation_summary[q]['sum_before'] for q in rating_columns]
increase_in_sums = [imputation_summary[q]['sum_after'] - imputation_summary[q]['sum_before'] for q in rating_columns]

# Highlight color for the specific question (Q4)
bar_colors = ['lightgray' if q != '4.Equanimity' else 'green' for q in questions]
fig, ax1 = plt.subplots(figsize=(14, 7))
ax1.bar(questions, sum_before, color=bar_colors, alpha=0.7)
ax1.set_xlabel('Question', fontsize=16)
ax1.set_ylabel('Sum Before Imputation', fontsize=16, color='black')
ax1.tick_params(axis='y', labelcolor='black')
ax1.set_xticks(np.arange(len(questions)))
ax1.set_xticklabels(questions, rotation=45, ha='right', fontsize=10)
ax2 = ax1.twinx()
ax2.plot(questions, increase_in_sums, color='red', marker='o', label='Increase in Sum', alpha=0.7)
```

```

ax2.set_ylabel('Increase in Sum', fontsize=16, color='red')
ax2.tick_params(axis='y', labelcolor='red')
plt.title('Sum Before and Increase in Sum After Imputation for Each Question', font
fig.tight_layout()
plt.show()

```



```

In [87]: wilcoxon_results_by_time_psilo_pla = {}
m = len(rating_columns)
for timepoint in timepoints:
    df_timepoint = df_cleaned_imputed[df_cleaned_imputed['Timepoint relative to drug'] == timepoint]
    placebo_scores = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg)'])]
    psilocybin_scores = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg)'])]

    wilcoxon_results_by_time_psilo_pla[timepoint] = {}
    wilcoxon_p_values = []
    wilcoxon_test_stats = []

    for col in rating_columns:
        try:
            wilcoxon_t_stat, wilcoxon_p_value = wilcoxon(placebo_scores[col], psilocybin_scores[col])
            wilcoxon_p_values.append(wilcoxon_p_value)
            wilcoxon_test_stats.append(wilcoxon_t_stat)
        except ValueError:
            wilcoxon_p_values.append(np.nan)
            wilcoxon_test_stats.append(None)

    valid_mask = ~np.isnan(wilcoxon_p_values)
    adjusted_p_values = np.full(len(wilcoxon_p_values), np.nan)
    if valid_mask.any():
        adjusted_p_values[valid_mask] = multipletests(np.array(wilcoxon_p_values))[v

    for col, wilcoxon_t_stat, adj_p_value in zip(rating_columns, wilcoxon_test_stats, adjusted_p_values):
        wilcoxon_results_by_time_psilo_pla[timepoint][col] = (wilcoxon_t_stat, adj_p_value)

    print(f"Results for Timepoint {timepoint} (minutes):")
    for col, (wilcoxon_t_stat, adj_p_value) in wilcoxon_results_by_time_psilo_pla[t

```

```
    print(f"{col}: Wilcoxon statistic = {wilcoxon_t_stat}, Bonferroni-Holm adju  
print("\n")
```

Results for Timepoint 0 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = None, Bonferroni-Holm adjusted P-value = nan
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 37.5, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 74.0, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 59.5, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 43.5, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 33.5, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 74.0, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 48.5, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 28.0, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 57.5, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 51.5, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 70.0, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 19.0, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 30 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 4.0, Bonferroni-Holm adjusted P-value = 0.028358990172091477
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 79.5, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 55.0, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 42.0, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$

10 = strongest imaginable): Wilcoxon statistic = 57.0, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 37.5, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 54.0, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 59.0, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 31.0, Bonferroni-Holm adjusted P-value = 0.36087616466806216
10. Feelings of joy (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 56.0, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 35.5, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 52.0, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 32.5, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 60 (minutes):

1. Overall Psilocybin Effect (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 1.0, Bonferroni-Holm adjusted P-value = 0.001312010485162263
2. Now-ness (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 80.5, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 71.0, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 54.5, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 63.5, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 38.0, Bonferroni-Holm adjusted P-value = 0.21323427208107654
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 66.5, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 33.5, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability (0 = none to 10 = strongest imaginable): Wilcoxon statistic = 3.0, Bonferroni-Holm adjusted P-value = 0.005687671146054502

10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 54.0, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 16.0, Bonferroni-Holm adjusted P-value = 0.13215729841338025
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 64.5, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 39.5, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 120 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 1.0, Bonferroni-Holm adjusted P-value = 2.47955322265625e-05
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 5.0, Bonferroni-Holm adjusted P-value = 0.0015854765941606243
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 34.0, Bonferroni-Holm adjusted P-value = 0.06787807954907459
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 110.0, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 23.5, Bonferroni-Holm adjusted P-value = 0.029994623306758113
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 1.0, Bonferroni-Holm adjusted P-value = 0.0010627879976395915
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 17.0, Bonferroni-Holm adjusted P-value = 0.0475915411967716
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 2.5, Bonferroni-Holm adjusted P-value = 0.00122696122945719
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 3.0, Bonferroni-Holm adjusted P-value = 5.7220458984375e-05
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 26.0, Bonferroni-Holm adjusted P-value = 0.03784279877519212
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 69.5, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 67.5, Bonferroni-Holm adjusted P-value = 0.4128570556640625
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 50.0, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 180 (minutes):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 1.239776611328125e-05
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 2.0, Bonferroni-Holm adjusted P-val
ue = 3.4332275390625e-05
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 0.0008525028899448955
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 9.0, Bonferroni-Holm adjusted P-val
ue = 0.002449746451882985
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 7.0, Bonferroni-Holm adjusted P-val
ue = 0.0001811981201171875
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 4.0, Bonferroni-Holm adjusted P-val
ue = 7.343292236328125e-05
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 11.5, Bonferroni-Holm adjusted P-val
ue = 0.0018498760338581267
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 6.5, Bonferroni-Holm adjusted P-val
ue = 0.0018114691866422824
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 0.0006857902075055516
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 8.5, Bonferroni-Holm adjusted P-val
ue = 0.0017851659017345447
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 58.5, Bonferroni-Holm adjusted P-val
ue = 0.10038375854492188
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 7.5, Bonferroni-Holm adjusted P-val
ue = 0.00021457672119140625
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 34.0, Bonferroni-Holm adjusted P-val
ue = 0.6920614909359382

Results for Timepoint 240 (minutes):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 1.239776611328125e-05
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 2.5, Bonferroni-Holm adjusted P-val
ue = 0.0012178612713498508
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 0.0012178612713498508
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): Wilcoxon statistic = 24.5, Bonferroni-Holm adjusted P-val
ue = 0.027056656979213917
5. Pure being and pure awareness ($\theta = \text{none to}$

```
10 = strongest imaginable): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 0.001325228379390167
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 0.0012178612713498508
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 6.5, Bonferroni-Holm adjusted P-val
ue = 0.0016645317420968292
8. Timelessness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 3.5, Bonferroni-Holm adjusted P-val
ue = 7.343292236328125e-05
9. Ineffability (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 2.5, Bonferroni-Holm adjusted P-val
ue = 5.7220458984375e-05
10. Feelings of joy (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 7.5, Bonferroni-Holm adjusted P-val
ue = 0.0014476776123046875
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 17.5, Bonferroni-Holm adjusted P-val
ue = 0.0014476776123046875
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 19.0, Bonferroni-Holm adjusted P-val
ue = 0.0014476776123046875
13. Negative emotional valence (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 33.0, Bonferroni-Holm adjusted P-val
ue = 0.6319081306793233
```

Results for Timepoint 300 (minutes):

```
1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-val
ue = 0.0015304919640933027
2. Now-ness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 10.5, Bonferroni-Holm adjusted P-val
ue = 0.0006818771362304688
3. Letting Go (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 15.0, Bonferroni-Holm adjusted P-val
ue = 0.005808853894941151
4. Equanimity (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 18.5, Bonferroni-Holm adjusted P-val
ue = 0.00769269237845995
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 4.0, Bonferroni-Holm adjusted P-val
ue = 0.0015776170615020232
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 10.0, Bonferroni-Holm adjusted P-val
ue = 0.004360536956183665
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 9.5, Bonferroni-Holm adjusted P-val
ue = 0.004360536956183665
8. Timelessness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 2.0, Bonferroni-Holm adjusted P-val
ue = 0.0025399141012161616
9. Ineffability (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 6.5, Bonferroni-Holm adjusted P-val
ue = 0.002902181872178863
```

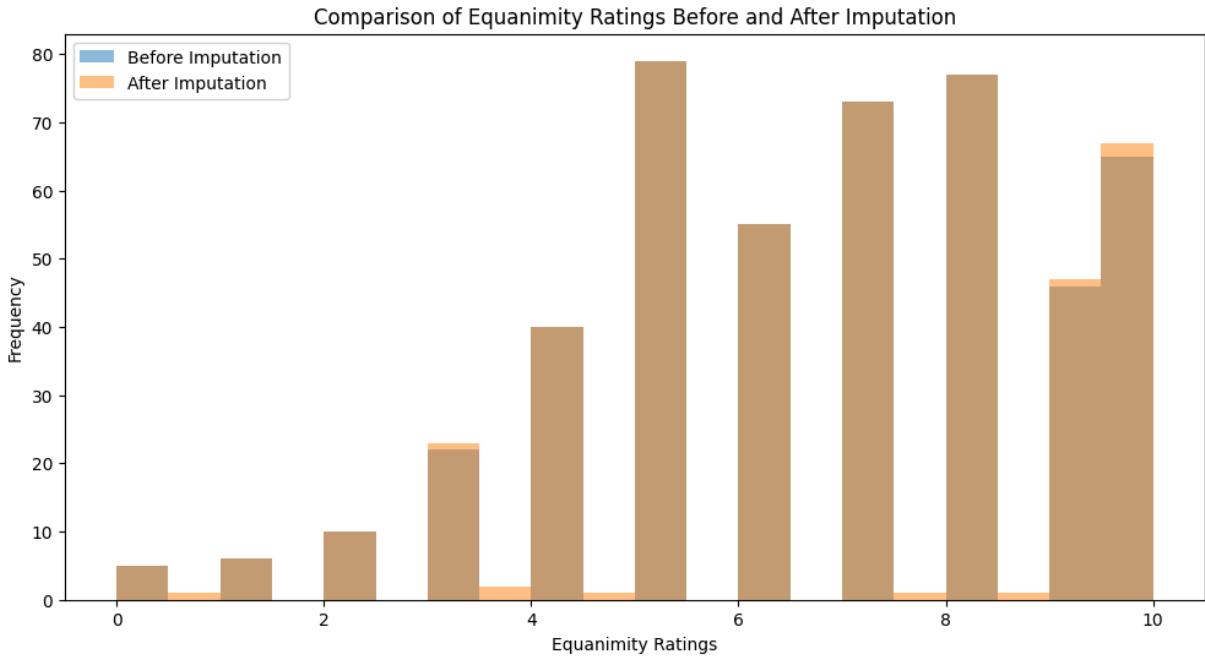
10. Feelings of joy (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 13.0, Bonferroni-Holm adjusted P-value = 0.004360536956183665
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 28.5, Bonferroni-Holm adjusted P-value = 0.014148260037230914
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 23.5, Bonferroni-Holm adjusted P-value = 0.01125866535217163
13. Negative emotional valence (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 20.0, Bonferroni-Holm adjusted P-value = 0.23824532313177882

Results for Timepoint 360 (minutes):

1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-value = 0.002426544451741681
2. Now-ness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 8.0, Bonferroni-Holm adjusted P-value = 0.017262930816086715
3. Letting Go (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 16.0, Bonferroni-Holm adjusted P-value = 0.007038000869236241
4. Equanimity (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 3.5, Bonferroni-Holm adjusted P-value = 0.005482245141092957
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 15.0, Bonferroni-Holm adjusted P-value = 0.017262930816086715
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 11.0, Bonferroni-Holm adjusted P-value = 0.017262930816086715
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 0.0, Bonferroni-Holm adjusted P-value = 0.004968295656007677
8. Timelessness (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 10.5, Bonferroni-Holm adjusted P-value = 0.011872612124758989
9. Ineffability (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 1.0, Bonferroni-Holm adjusted P-value = 0.005482245141092957
10. Feelings of joy (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 19.5, Bonferroni-Holm adjusted P-value = 0.017262930816086715
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 42.5, Bonferroni-Holm adjusted P-value = 0.06557937420241276
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 9.0, Bonferroni-Holm adjusted P-value = 0.009637323611717062
13. Negative emotional valence (0 = none to
10 = strongest imaginable): Wilcoxon statistic = 23.0, Bonferroni-Holm adjusted P-value = 0.6387290943002656

```
In [89]: plt.figure(figsize=(12, 6))
plt.hist(df_cleaned['4. Equanimity (0 = none to\n10 = strongest imaginable)'], bins
plt.hist(df_cleaned_imputed['4. Equanimity (0 = none to\n10 = strongest imaginable)
plt.xlabel('Equanimity Ratings')
plt.ylabel('Frequency')
plt.title('Comparison of Equanimity Ratings Before and After Imputation')
plt.legend()
plt.show
```

Out[89]: <function matplotlib.pyplot.show(close=None, block=None)>



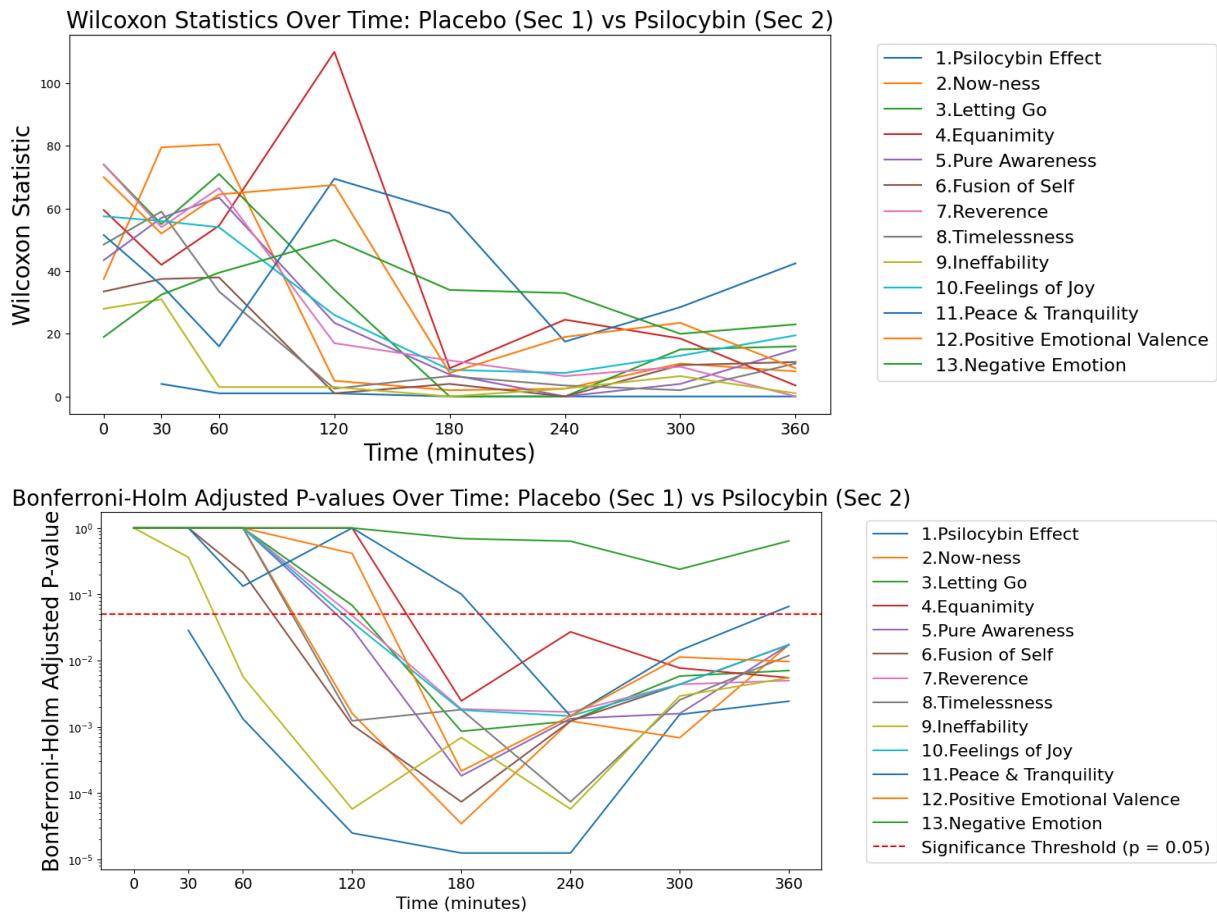
```
In [272... wilcoxon_t_stats_by_question = {col: [wilcoxon_results_by_time_psilo_pla[timepoint]
wilcoxon_p_values_by_question = {col: [wilcoxon_results_by_time_psilo_pla[timepoint

wilcoxon_p_values_by_question = {col: [np.nan if v == "NA" else v for v in p_values

plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, wilcoxon_t_stats_by_question[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize = 20)
plt.ylabel('Wilcoxon Statistic', fontsize = 20)
plt.xticks([0, 30, 60, 120, 180, 240, 300, 360], fontsize = 14)
plt.title('Wilcoxon Statistics Over Time: Placebo (Sec 1) vs Psilocybin (Sec 2)', f
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize = 16)
plt.show()

plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, wilcoxon_p_values_by_question[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize = 16)
plt.ylabel('Bonferroni-Holm Adjusted P-value', fontsize = 20)
plt.xticks([0, 30, 60, 120, 180, 240, 300, 360], fontsize = 14)
plt.title('Bonferroni-Holm Adjusted P-values Over Time: Placebo (Sec 1) vs Psilocyb
plt.axhline(y=0.05, color='r', linestyle='--', label='Significance Threshold (p = 0
plt.yscale('log')
```

```
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize = 16)
plt.show()
```



Sections for Independent T Test for Psilocybin (Sec 1) vs Placebo (Sec 1)

```
In [61]: independent_results_by_time_psilo_pla = {}

for timepoint in timepoints:
    df_timepoint = df_cleaned_imputed[df_cleaned_imputed['Timepoint relative to drug'] == timepoint]
    placebo_scores_section1 = df_timepoint[(df_timepoint['Condition (PLA: placebo, Psilocybin)'] == 'Placebo')]
    psilocybin_scores_section1 = df_timepoint[(df_timepoint['Condition (PLA: placebo, Psilocybin)'] == 'Psilocybin')]

    independent_results_by_time_psilo_pla[timepoint] = {}
    p_values = []
    t_stats = []

    for col in rating_columns:
        try:
            t_stat, p_value = stats.ttest_ind(placebo_scores_section1[col], psilocybin_scores_section1[col])
            p_values.append(p_value)
            t_stats.append(t_stat)
        except ValueError:
            p_values.append(np.nan)
            t_stats.append(np.nan)

independent_results_by_time_psilo_pla
```

```
# Apply Holm correction
adjusted_p_values = multipletests(p_values, alpha=0.05, method='holm')[1]
independent_results_by_time_psilo_pla[timepoint] = {col: (t_stat, adj_p_value) for timepoint, results in independent_results_by_time_psilo_pla.items():
    print(f"Results for Timepoint {timepoint} (Psilocybin (Sec 1) vs Placebo (S
for col, (t_stat, adj_p_value) in results.items():
    print(f"{col}: T-statistic = {t_stat}, Bonferroni-Holm adjusted P-value = {
print("\n")
```

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = nan, Bonferroni-Holm adjusted P-value = NA
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.010462094021844254, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.4106802868547341, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.4621971015345972, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.473218228828803, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.41198550354253083, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.9793048011484835, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.47500000000000026, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.5550387187548214, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.47946061998807177, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.5434455494020758, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.48424964604039233, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.4983788459631745, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 30 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.552540076628362, Bonferroni-Holm adjusted P-value = 0.19285480191151144
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.6171130204740658, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.2738783380405275, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.6579810812815282, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$

10 = strongest imaginable): T-statistic = -0.5173156617226574, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = 0.0276658177100034, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = -0.2931360119622945, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -0.9024347734055966, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -0.33768192496148414, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = 0.39376246564579326, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = 1.0035091622007186, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = 0.06512620114237956, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = -1.598275917983452, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 30 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 60 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

1. Overall Psilocybin Effect (0 = none to

10 = strongest imaginable): T-statistic = -5.609360811795251, Bonferroni-Holm adjusted P-value = 2.541914801872964e-05

2. Now-ness (0 = none to

10 = strongest imaginable): T-statistic = -2.0071011576594713, Bonferroni-Holm adjusted P-value = 0.41512640974543746

3. Letting Go (0 = none to

10 = strongest imaginable): T-statistic = -0.09475440802297211, Bonferroni-Holm adjusted P-value = 1.0

4. Equanunity (0 = none to

10 = strongest imaginable): T-statistic = 1.191249336822786, Bonferroni-Holm adjusted P-value = 0.9637735109085976

5. Pure being and pure awareness (0 = none to

10 = strongest imaginable): T-statistic = -2.3743176532001242, Bonferroni-Holm adjusted P-value = 0.2046244335811009

6. Fusion of your personal self into a larger whole (0 = none to

10 = strongest imaginable): T-statistic = -3.4428667763019623, Bonferroni-Holm adjusted P-value = 0.016988770160997087

7. Sense of reverence or sacredness (0 = none to

10 = strongest imaginable): T-statistic = -1.460443727519181, Bonferroni-Holm adjusted P-value = 0.7619372684042587

8. Timelessness (0 = none to

10 = strongest imaginable): T-statistic = -2.5905615557851416, Bonferroni-Holm adjusted P-value = 0.1382671884537857

9. Ineffability (0 = none to

10 = strongest imaginable): T-statistic = -2.6199512209740337, Bonferroni-Holm adjusted P-value = 0.1382671884537857
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = 0.1725465173831758, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = 1.9569001793369099, Bonferroni-Holm adjusted P-value = 0.41512640974543746
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = 1.1571144961609732, Bonferroni-Holm adjusted P-value = 0.9637735109085976
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = -1.822620655442316, Bonferroni-Holm adjusted P-value = 0.4574207420219028

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 30 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 60 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 120 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): T-statistic = -7.6675498521689684, Bonferroni-Holm adjusted P-value = 4.0702858154764465e-08
2. Now-ness (0 = none to
10 = strongest imaginable): T-statistic = -4.533249796288661, Bonferroni-Holm adjusted P-value = 0.0005074278427403097
3. Letting Go (0 = none to
10 = strongest imaginable): T-statistic = -2.082452738874872, Bonferroni-Holm adjusted P-value = 0.22042252655809091
4. Equanimity (0 = none to
10 = strongest imaginable): T-statistic = -0.28805412687489096, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): T-statistic = -3.8960314885357628, Bonferroni-Holm adjusted P-value = 0.0030715379740050446
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = -4.81525868672134, Bonferroni-Holm adjusted P-value = 0.00023603464542264392
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = -3.048626322549102, Bonferroni-Holm adjusted P-value = 0.025027564788887666
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -5.111229536492285, Bonferroni-Holm adjusted P-value = 0.00010312484652864591
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -5.31993569543655, Bonferroni-Holm adjusted P-value = 5.8422290056354224e-05
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = -3.6393916092686887, Bonferroni-Holm adjusted P-value = 0.0056688989093444395
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = -1.3932846575526983, Bonferroni-Holm adjusted P-value = 0.6865228011956104
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = -1.0377096689857654, Bonferroni-Holm adjusted P-value = 0.9178908956996263

13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.6710040081666133, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 30 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 60 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 120 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 180 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -7.484703545940707, Bonferroni-Holm adjusted P-value = 7.130437302594694e-08
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.380088228751307, Bonferroni-Holm adjusted P-value = 0.0007872897288664362
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.788705138031388, Bonferroni-Holm adjusted P-value = 0.04111394668947248
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.2851662223104158, Bonferroni-Holm adjusted P-value = 0.7770653425107248
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.389570847510182, Bonferroni-Holm adjusted P-value = 0.0007872897288664362
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.945296223379279, Bonferroni-Holm adjusted P-value = 0.00017322937303207472
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.269957506369274, Bonferroni-Holm adjusted P-value = 0.013740336659159432
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -5.119977253616796, Bonferroni-Holm adjusted P-value = 0.0001094585470086568
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.784389888206902, Bonferroni-Holm adjusted P-value = 0.0002597644034182775
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.914839157704937, Bonferroni-Holm adjusted P-value = 0.0025428090511084725
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -1.623515184990318, Bonferroni-Holm adjusted P-value = 0.3382416062227282
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.574670477256183, Bonferroni-Holm adjusted P-value = 0.056212227775221044
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -1.394483717203298, Bonferroni-Holm adjusted P-value = 0.34254251582175665

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 30 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 60 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 120 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 180 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 240 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -12.029107670838291, Bonferroni-Holm adjusted P-value = 2.0598858262843886e-13
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.9579553749169363, Bonferroni-Holm adjusted P-value = 0.030652813066794425
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.820768804014625, Bonferroni-Holm adjusted P-value = 0.004308850352091664
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.467065289170506, Bonferroni-Holm adjusted P-value = 0.054730395107195545
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.781557596063955, Bonferroni-Holm adjusted P-value = 0.004308850352091664
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.967631988926796, Bonferroni-Holm adjusted P-value = 0.0031081824637245073
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -4.492936147654533, Bonferroni-Holm adjusted P-value = 0.0007017650479081939
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -5.062558286368434, Bonferroni-Holm adjusted P-value = 0.000131017027854883
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.270829991554526, Bonferroni-Holm adjusted P-value = 0.015991960888138958
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.139075208020157, Bonferroni-Holm adjusted P-value = 0.07783233538459366
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.9721264724327194, Bonferroni-Holm adjusted P-value = 0.030652813066794425
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.879945114034409, Bonferroni-Holm adjusted P-value = 0.030652813066794425
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.7157812286555142, Bonferroni-Holm adjusted P-value = 0.47850203237967104

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 30 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 60 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 120 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 180 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 240 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

Results for Timepoint 300 (Psilocybin (Sec 1) vs Placebo (Sec 1)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -8.217294912362242, Bonferroni-Holm adjusted P-value = 7.698070941777318e-09
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -3.52079741079654, Bonferroni-Holm adjusted P-value = 0.007952701001037383
3. Letting Go ($\theta = \text{none to}$

10 = strongest imaginable): T-statistic = -4.005862419730912, Bonferroni-Holm adjusted P-value = 0.0027751991036677835
4. Equanimity (θ = none to
10 = strongest imaginable): T-statistic = -3.4883766099348574, Bonferroni-Holm adjusted P-value = 0.007952701001037383
5. Pure being and pure awareness (θ = none to
10 = strongest imaginable): T-statistic = -3.705201476169394, Bonferroni-Holm adjusted P-value = 0.0053595022411012305
6. Fusion of your personal self into a larger whole (θ = none to
10 = strongest imaginable): T-statistic = -4.423390065930259, Bonferroni-Holm adjusted P-value = 0.0008679888704425559
7. Sense of reverence or sacredness (θ = none to
10 = strongest imaginable): T-statistic = -4.599261838267847, Bonferroni-Holm adjusted P-value = 0.0005523427207397723
8. Timelessness (θ = none to
10 = strongest imaginable): T-statistic = -2.578093165289796, Bonferroni-Holm adjusted P-value = 0.02787111376389835
9. Ineffability (θ = none to
10 = strongest imaginable): T-statistic = -2.9261274469652157, Bonferroni-Holm adjusted P-value = 0.019127894741568677
10. Feelings of joy (θ = none to
10 = strongest imaginable): T-statistic = -2.997172053272729, Bonferroni-Holm adjusted P-value = 0.019127894741568677
11. Feelings of peace and tranquility (θ = none to
10 = strongest imaginable): T-statistic = -3.160093088646672, Bonferroni-Holm adjusted P-value = 0.015456282851404823
12. Positive Emotional Valence (θ = none to
10 = strongest imaginable): T-statistic = -3.789154452194632, Bonferroni-Holm adjusted P-value = 0.0047253502698695205
13. Negative emotional valence (θ = none to
10 = strongest imaginable): T-statistic = -0.6042066489369918, Bonferroni-Holm adjusted P-value = 0.5492968562803799

Results for Timepoint 0 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 30 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 60 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 120 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 180 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 240 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 300 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
Results for Timepoint 360 (Psilocybin (Sec 1) vs Placebo (Sec 1)):
1. Overall Psilocybin Effect (θ = none to
10 = strongest imaginable): T-statistic = -5.61962115183335, Bonferroni-Holm adjusted P-value = 2.460904321270845e-05
2. Now-ness (θ = none to
10 = strongest imaginable): T-statistic = -2.4501332397753726, Bonferroni-Holm adjusted P-value = 0.09498988229837235
3. Letting Go (θ = none to
10 = strongest imaginable): T-statistic = -2.855177677501452, Bonferroni-Holm adjusted P-value = 0.05188608150056331
4. Equanimity (θ = none to
10 = strongest imaginable): T-statistic = -3.3357291090473784, Bonferroni-Holm adjusted P-value = 0.021004990149550883
5. Pure being and pure awareness (θ = none to
10 = strongest imaginable): T-statistic = -2.926078476401547, Bonferroni-Holm adjusted

```

ed P-value = 0.05188608150056331
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = -2.8967465012584706, Bonferroni-Holm adjust
ed P-value = 0.05188608150056331
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = -4.374638829163784, Bonferroni-Holm adjust
ed P-value = 0.001098534802291222
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -2.195887879822549, Bonferroni-Holm adjust
ed P-value = 0.11519989372821164
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -2.613822899356994, Bonferroni-Holm adjust
ed P-value = 0.07657019643328639
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = -2.272482913726537, Bonferroni-Holm adjust
ed P-value = 0.11519989372821164
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = -3.2414033023014923, Bonferroni-Holm adjust
ed P-value = 0.0247682956213385
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = -1.9674107033687713, Bonferroni-Holm adjust
ed P-value = 0.11519989372821164
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = 1.0539774830183923, Bonferroni-Holm adjust
ed P-value = 0.2985489612904268

```

In [270...]

```

import matplotlib.pyplot as plt
import numpy as np

t_stats_by_question_psilo_pla = {col: [independent_results_by_time_psilo_pla[timepo
p_values_by_question_psilo_pla = {col: [independent_results_by_time_psilo_pla[timep

p_values_by_question_psilo_pla = {col: [np.nan if v == "NA" else v for v in p_value

plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, t_stats_by_question_psilo_pla[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize = 20)
plt.ylabel('T-statistic', fontsize = 20)
plt.title('Independent T-statistics Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1')
plt.xticks(timepoints, [0, 30, 60, 120, 180, 240, 300, 360], fontsize = 16)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize = 16)
plt.show()

plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, p_values_by_question_psilo_pla[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize = 20)
plt.ylabel('Bonferroni-Holm Adjusted P-value', fontsize = 20)
plt.title('Adjusted P-values Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1)', font
plt.axhline(y=0.05, color='r', linestyle='--', label='Significance Threshold (p = 0
plt.xticks(timepoints, [0, 30, 60, 120, 180, 240, 300, 360], fontsize = 16)
plt.yscale('log')

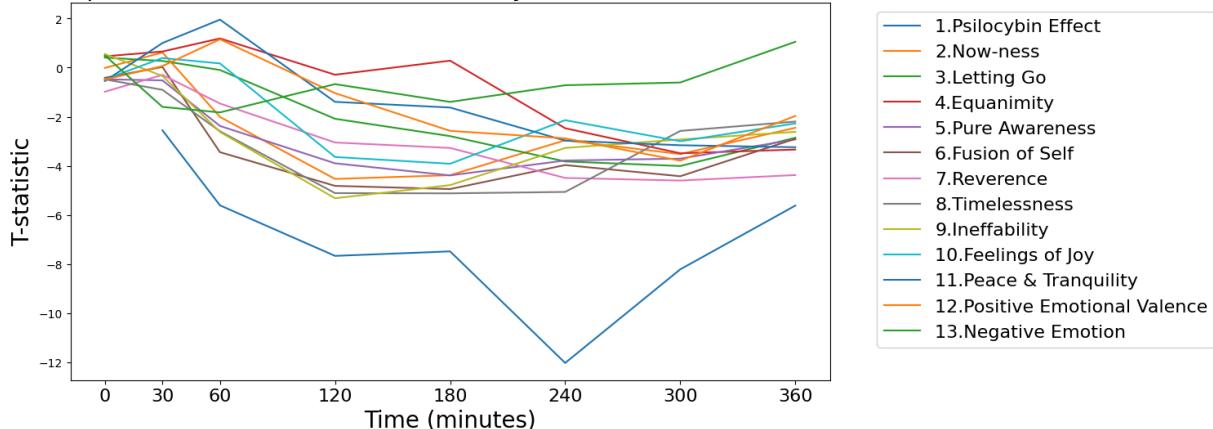
```

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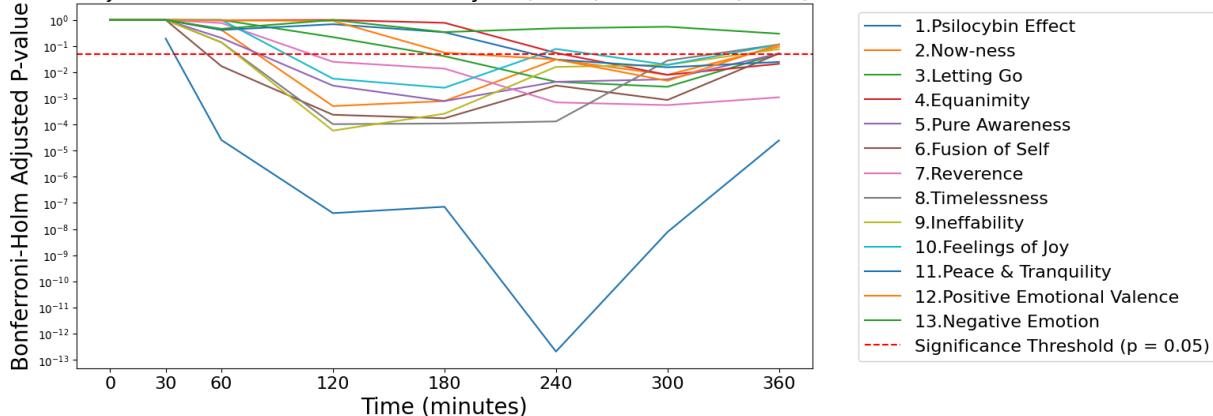
y_ticks = [10**i for i in range(0, -14, -1)] # From 10^0 to 10^-11
y_labels = [f'$10^{{{i}}}$' for i in range(0, -14, -1)]
plt.yticks(y_ticks, y_labels)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize = 16)
plt.show()

```

Independent T-statistics Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1)



Adjusted P-values Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1)



Independent T test for Psilocybin (Sec 1) vs Psilocybin (Sec 2)

```

In [59]: independent_results_by_time_psilo_both = {}

for timepoint in timepoints:
    df_timepoint = df_cleaned_imputed[df_cleaned_imputed['Timepoint relative to drug'] == timepoint]
    psilocybin_scores_section1 = df_timepoint[(df_timepoint['Condition (PLA: placebo)'] == 'placebo') & (df_timepoint['Condition (DMSO: psilocybin)'] == 'psilocybin')]
    psilocybin_scores_section2 = df_timepoint[(df_timepoint['Condition (PLA: placebo)'] == 'psilocybin') & (df_timepoint['Condition (DMSO: psilocybin)'] == 'placebo')]

    independent_results_by_time_psilo_both[timepoint] = {}
    p_values = []
    t_stats = []

    for col in rating_columns:
        try:
            t_stat, p_value = stats.ttest_ind(psilocybin_scores_section1[col], psilocybin_scores_section2[col])
            p_values.append(p_value)
            t_stats.append(t_stat)
        except ValueError:
            pass

    independent_results_by_time_psilo_both[timepoint] = {'p_values': p_values, 't_stats': t_stats}

```

```
p_values.append(np.nan)
t_stats.append(np.nan)

adjusted_p_values = multipletests(p_values, alpha=0.05, method='holm')[1]
independent_results_by_time_psilo_both[timepoint] = {col: (t_stat, adj_p_value)

for timepoint, results in independent_results_by_time_psilo_both.items():
    print(f"Results for Timepoint {timepoint} (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):")
    for col, (t_stat, adj_p_value) in results.items():
        print(f"{col}: T-statistic = {t_stat}, Bonferroni-Holm adjusted P-value = {adj_p_value:.4f}")
    print("\n")
```

Results for Timepoint 0 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = nan, Bonferroni-Holm adjusted P-value = NA
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.15724486255396639, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.8342903190114351, Bonferroni-Holm adjusted P-value = 1.0
4. Equanunity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -1.1712659258685116, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.8323079483307407, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.634393146678116, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 1.052774113156917, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.12449985817025636, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.30904380028073974, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.0037875127031394827, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.41601829517057726, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.22640730742923493, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.8656993990468131, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 30 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.708496324155043, Bonferroni-Holm adjusted P-value = 1.0
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.1735382574598987, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.5049852468664141, Bonferroni-Holm adjusted P-value = 1.0
4. Equanunity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.5645648270772881, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.5123894015596792, Bonferroni-Holm adjusted P-value = 1.0

ed P-value = 1.0
6. Fusion of your personal self into a larger whole ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 0.4229659368211123, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 0.3874886794825038, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 0.4935214824764955, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = -1.422720240151156, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = -0.5070689406933617, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = -0.044179902781732755, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 0.20335301687157006, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 1.1142424557558137, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 60 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

1. Overall Psilocybin Effect ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = -0.8649262801031674, Bonferroni-Holm adjusted P-value = 1.0
2. Now-ness ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 0.9069496257709053, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = -0.3704673395339993, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = -0.31582120034350764, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 1.1404969051188492, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 0.8266635833571297, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 1.2826410982816432, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 1.6155199338932924, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = -1.1121369054047567, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy ($0 = \text{none to } 10 = \text{strongest imaginable}$): T-statistic = 1.1121369054047567, Bonferroni-Holm adjusted P-value = 1.0

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10 = strongest imaginable): T-statistic = -0.9697800479093918, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = 0.16556001968972328, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = -1.2074198893430597, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = 0.7966665693565468, Bonferroni-Holm adjusted P-value = 1.0
```

Results for Timepoint 120 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

```
1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): T-statistic = -0.5526037342965412, Bonferroni-Holm adjusted P-value = 1.0
2. Now-ness (0 = none to
10 = strongest imaginable): T-statistic = 0.46319528179966396, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go (0 = none to
10 = strongest imaginable): T-statistic = -0.2692125022205202, Bonferroni-Holm adjusted P-value = 1.0
4. EQUANIMITY (0 = none to
10 = strongest imaginable): T-statistic = 0.23225605584011474, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): T-statistic = 1.1158457898601233, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = 0.6631044320456717, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = 0.695637654140754, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = 0.5775629435643332, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -0.2417628350464369, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = 0.29817623045212494, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = 0.6809569915272349, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = -0.3934734533198719, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = -0.2927043563628737, Bonferroni-Holm adjusted P-value = 1.0
```

Results for Timepoint 180 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.0688162339954355, Bonferroni-Holm adjusted P-value = 0.5449900278976383
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -1.838554347723076, Bonferroni-Holm adjusted P-value = 0.7907269964696697
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -1.851473066767596, Bonferroni-Holm adjusted P-value = 0.7907269964696697
4. Equanunity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -2.9355334677109997, Bonferroni-Holm adjusted P-value = 0.07311493426912982
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.019124361768888574, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.20850786173247773, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.17555582335897635, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.012055984091250884, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -1.4347666057601434, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.694157521287934, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.22617616290112233, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.902611237119035, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.7133240015522683, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 240 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = 0.08131057443956868, Bonferroni-Holm adjusted P-value = 1.0
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.8970255115238114, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.9576335644679648, Bonferroni-Holm adjusted P-value = 1.0
4. Equanunity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.2995992831068127, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): T-statistic = -0.2736503836738785, Bonferroni-Holm adjusted P-value = 1.0

ted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): T-statistic = 0.34982520768901487, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): T-statistic = 0.5884102042160854, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness (0 = none to 10 = strongest imaginable): T-statistic = 0.4013229045596892, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability (0 = none to 10 = strongest imaginable): T-statistic = -1.5731231293560861, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy (0 = none to 10 = strongest imaginable): T-statistic = -1.001567544240779, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to 10 = strongest imaginable): T-statistic = -0.44730654509917084, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to 10 = strongest imaginable): T-statistic = -0.44089070684764503, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence (0 = none to 10 = strongest imaginable): T-statistic = 1.2078393323518763, Bonferroni-Holm adjusted P-value = 1.0

Results for Timepoint 300 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

1. Overall Psilocybin Effect (0 = none to 10 = strongest imaginable): T-statistic = 0.30056812053445303, Bonferroni-Holm adjusted P-value = 1.0
2. Now-ness (0 = none to 10 = strongest imaginable): T-statistic = 0.3243160699709938, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go (0 = none to 10 = strongest imaginable): T-statistic = 1.4100328603470824, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity (0 = none to 10 = strongest imaginable): T-statistic = 0.5931282467275487, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness (0 = none to 10 = strongest imaginable): T-statistic = 1.1146904931226878, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): T-statistic = 1.259708132398963, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): T-statistic = 0.9969331413629718, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness (0 = none to 10 = strongest imaginable): T-statistic = -0.10943686575232471, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability (0 = none to 10 = strongest imaginable): T-statistic = -0.45377348018457575, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy (0 = none to

```
10 = strongest imaginable): T-statistic = -0.25889538811303214, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = 0.5345923664472051, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = 0.7230151125137767, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = -0.12277896116311489, Bonferroni-Holm adjusted P-value = 1.0
```

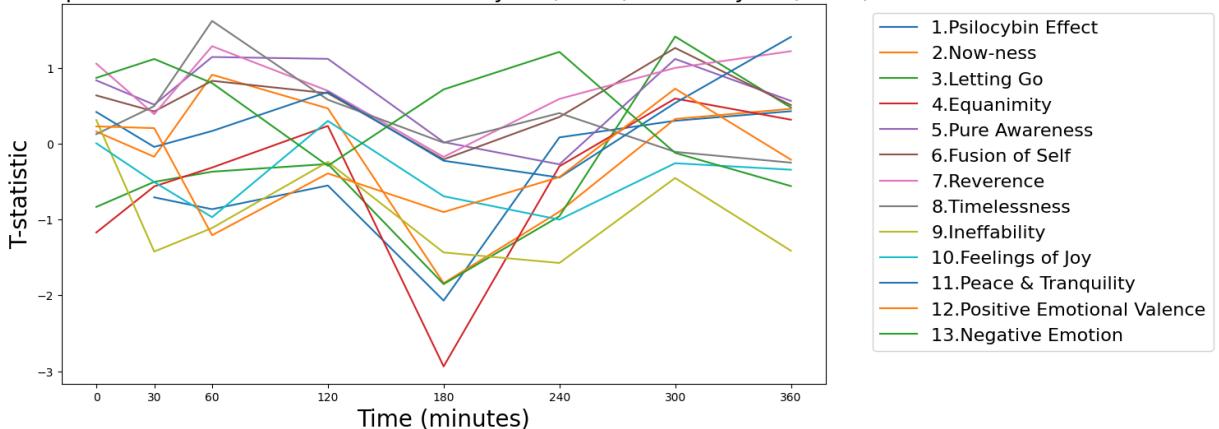
Results for Timepoint 360 (Psilocybin (Sec 1) vs Psilocybin (Sec 2)):

```
1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): T-statistic = 0.4263140225290091, Bonferroni-Holm adjusted P-value = 1.0
2. Now-ness (0 = none to
10 = strongest imaginable): T-statistic = 0.45781682478304736, Bonferroni-Holm adjusted P-value = 1.0
3. Letting Go (0 = none to
10 = strongest imaginable): T-statistic = 0.4749999999999996, Bonferroni-Holm adjusted P-value = 1.0
4. Equanimity (0 = none to
10 = strongest imaginable): T-statistic = 0.31440313490047855, Bonferroni-Holm adjusted P-value = 1.0
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): T-statistic = 0.5618438031282946, Bonferroni-Holm adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): T-statistic = 0.5068421878138468, Bonferroni-Holm adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): T-statistic = 1.2167627967722088, Bonferroni-Holm adjusted P-value = 1.0
8. Timelessness (0 = none to
10 = strongest imaginable): T-statistic = -0.25120149239409695, Bonferroni-Holm adjusted P-value = 1.0
9. Ineffability (0 = none to
10 = strongest imaginable): T-statistic = -1.4116219388374753, Bonferroni-Holm adjusted P-value = 1.0
10. Feelings of joy (0 = none to
10 = strongest imaginable): T-statistic = -0.34450514088972417, Bonferroni-Holm adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): T-statistic = 1.4050820556560217, Bonferroni-Holm adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): T-statistic = -0.2118643214841993, Bonferroni-Holm adjusted P-value = 1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): T-statistic = -0.5601272741196344, Bonferroni-Holm adjusted P-value = 1.0
```

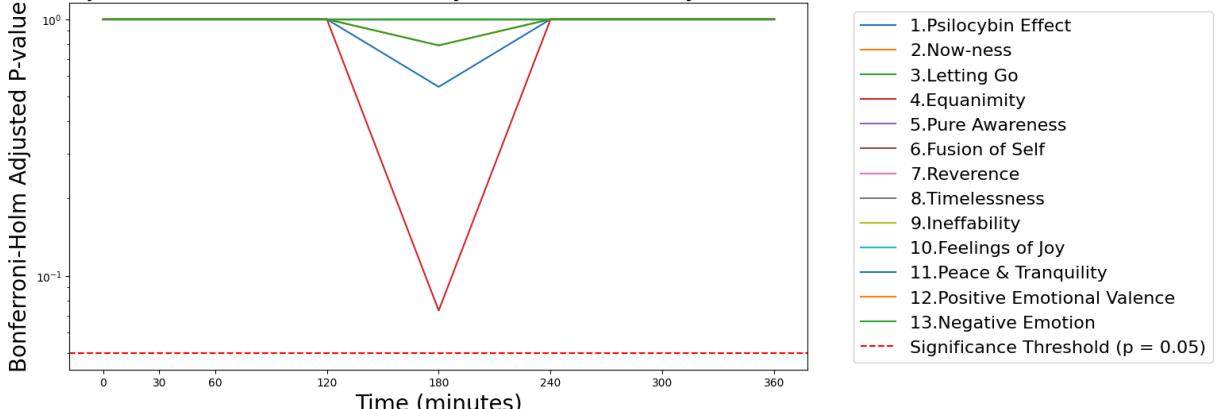
```
In [188... t_stats_by_question_psilo_both = {col: [independent_results_by_time_psilo_both[time_p_values_by_question_psilo_both = {col: [independent_results_by_time_psilo_both[time_p_values_by_question_psilo_both = {col: [np.nan if v == "NA" else v for v in p_value
plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, t_stats_by_question_psilo_both[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('T-statistic', fontsize=20)
plt.xticks(specific_timepoints)
plt.title('Independent T-statistics Over Time: Psilocybin (Sec 1) vs Psilocybin (Sec 2)', fontcolor='red')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize=16)
plt.show()

plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, p_values_by_question_psilo_both[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Bonferroni-Holm Adjusted P-value', fontsize=20)
plt.xticks(specific_timepoints)
plt.title('Adjusted P-values Over Time: Psilocybin (Sec 1) vs Psilocybin (Sec 2)', fontcolor='red')
plt.axhline(y=0.05, color='r', linestyle='--', label='Significance Threshold (p = 0.05)')
plt.yscale('log')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize=16)
plt.show()
```

Independent T-statistics Over Time: Psilocybin (Sec 1) vs Psilocybin (Sec 2)



Adjusted P-values Over Time: Psilocybin (Sec 1) vs Psilocybin (Sec 2)



Section for Mann U Test for Psilocybin (Sec 1) vs Placebo (Sec 1)

In [127...]

```

mannwhitney_results_by_time_psilo_pla = {}

for timepoint in timepoints:
    df_timepoint = df_cleaned_imputed[df_cleaned_imputed['Timepoint relative to drug administration'] == timepoint]
    placebo_scores = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg psilocybin)'] == 'placebo')]
    psilocybin_scores = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg psilocybin)'] == 'psilocybin')]

    mannwhitney_results_by_time_psilo_pla[timepoint] = {}
    mannwhitney_p_values = []
    mannwhitney_test_stats = []

    for col in rating_columns:
        try:
            u_stat, p_value = mannwhitneyu(placebo_scores[col], psilocybin_scores[col])
            mannwhitney_p_values.append(p_value)
            mannwhitney_test_stats.append(u_stat)
        except ValueError:
            mannwhitney_p_values.append(np.nan)
            mannwhitney_test_stats.append(None)

    # Apply Bonferroni-Holm correction
    valid_mask = ~np.isnan(mannwhitney_p_values)
    adjusted_p_values = np.full(len(mannwhitney_p_values), np.nan)
    if valid_mask.any():
        adjusted_p_values[valid_mask] = multipletests(np.array(mannwhitney_p_values))

    # Store results with adjusted p-values
    for col, u_stat, adj_p_value in zip(rating_columns, mannwhitney_test_stats, adjusted_p_values):
        mannwhitney_results_by_time_psilo_pla[timepoint][col] = (u_stat, adj_p_value)

for timepoint in timepoints:
    print(f"Results for Timepoint {timepoint} (minutes):")
    for col, (u_stat, adj_p_value) in mannwhitney_results_by_time_psilo_pla[timepoint].items():
        print(f"\t{col}: U-statistic = {u_stat}, Bonferroni-Holm Adjusted P-value = {adj_p_value}")
    print("\n")

```

Results for Timepoint 0 (minutes):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 199.5, Bonferroni-Holm Adjusted P-value = 1.0
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 207.0, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 217.0, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 217.5, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 187.0, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 184.5, Bonferroni-Holm Adjusted P-value = 1.0
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 165.5, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 183.0, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 206.5, Bonferroni-Holm Adjusted P-value = 1.0
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 177.0, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 180.5, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 181.5, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 210.5, Bonferroni-Holm Adjusted P-value = 1.0

Results for Timepoint 30 (minutes):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 121.0, Bonferroni-Holm Adjusted P-value = 0.2836246729423386
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 223.0, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 205.5, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 225.0, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$

10 = strongest imaginable): U-statistic = 183.0, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): U-statistic = 199.5, Bonferroni-Holm Adjusted P-value = 1.0
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): U-statistic = 188.5, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness (0 = none to 10 = strongest imaginable): U-statistic = 171.5, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability (0 = none to 10 = strongest imaginable): U-statistic = 194.5, Bonferroni-Holm Adjusted P-value = 1.0
10. Feelings of joy (0 = none to 10 = strongest imaginable): U-statistic = 213.5, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility (0 = none to 10 = strongest imaginable): U-statistic = 233.0, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence (0 = none to 10 = strongest imaginable): U-statistic = 197.5, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence (0 = none to 10 = strongest imaginable): U-statistic = 163.5, Bonferroni-Holm Adjusted P-value = 1.0

Results for Timepoint 60 (minutes):

1. Overall Psilocybin Effect (0 = none to 10 = strongest imaginable): U-statistic = 61.5, Bonferroni-Holm Adjusted P-value = 0.0017161342938125375
2. Now-ness (0 = none to 10 = strongest imaginable): U-statistic = 131.5, Bonferroni-Holm Adjusted P-value = 0.5104239462752372
3. Letting Go (0 = none to 10 = strongest imaginable): U-statistic = 194.5, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity (0 = none to 10 = strongest imaginable): U-statistic = 233.5, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness (0 = none to 10 = strongest imaginable): U-statistic = 116.5, Bonferroni-Holm Adjusted P-value = 0.2168726348709792
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): U-statistic = 88.5, Bonferroni-Holm Adjusted P-value = 0.03078731546985486
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): U-statistic = 146.0, Bonferroni-Holm Adjusted P-value = 0.8850040967142876
8. Timelessness (0 = none to 10 = strongest imaginable): U-statistic = 113.5, Bonferroni-Holm Adjusted P-value = 0.19471818734311597
9. Ineffability (0 = none to 10 = strongest imaginable): U-statistic = 111.0, Bonferroni-Holm Adjusted P-value = 0.18012376621229848

10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 203.5, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 266.5, Bonferroni-Holm Adjusted P-value = 0.5104239462752372
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 239.0, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 154.0, Bonferroni-Holm Adjusted P-value = 1.0

Results for Timepoint 120 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 37.0, Bonferroni-Holm Adjusted P-value = 8.487749904755386e-05
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 59.0, Bonferroni-Holm Adjusted P-value = 0.0013023959508915754
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 108.5, Bonferroni-Holm Adjusted P-value = 0.0651658114086821
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 174.0, Bonferroni-Holm Adjusted P-value = 0.9873714773485955
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 76.0, Bonferroni-Holm Adjusted P-value = 0.006415000190946352
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 58.5, Bonferroni-Holm Adjusted P-value = 0.0013023959508915754
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 91.0, Bonferroni-Holm Adjusted P-value = 0.022779150261956392
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 51.0, Bonferroni-Holm Adjusted P-value = 0.0006435057321088092
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 52.5, Bonferroni-Holm Adjusted P-value = 0.0007316246091418115
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 92.0, Bonferroni-Holm Adjusted P-value = 0.022779150261956392
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 149.5, Bonferroni-Holm Adjusted P-value = 0.5251658340177764
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 139.5, Bonferroni-Holm Adjusted P-value = 0.4184621925605325
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 205.0, Bonferroni-Holm Adjusted P-value = 0.9873714773485955

Results for Timepoint 180 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 48.0, Bonferroni-Holm Adjusted P-value = 0.0002342017705930407
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 59.5, Bonferroni-Holm Adjusted P-value = 0.0012971998873909272
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 98.5, Bonferroni-Holm Adjusted P-value = 0.023698901194274924
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 193.0, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 69.5, Bonferroni-Holm Adjusted P-value = 0.0031960764660465923
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 56.0, Bonferroni-Holm Adjusted P-value = 0.00099248006000496
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 79.5, Bonferroni-Holm Adjusted P-value = 0.006442421316208791
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 54.0, Bonferroni-Holm Adjusted P-value = 0.0007419148056396973
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 63.5, Bonferroni-Holm Adjusted P-value = 0.0019646022335407295
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 75.5, Bonferroni-Holm Adjusted P-value = 0.005147408439613355
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 123.5, Bonferroni-Holm Adjusted P-value = 0.11649238605302813
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 94.5, Bonferroni-Holm Adjusted P-value = 0.021067310623589835
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 198.5, Bonferroni-Holm Adjusted P-value = 1.0

Results for Timepoint 240 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 4.0, Bonferroni-Holm Adjusted P-value = 4.3416771005741696e-07
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 98.0, Bonferroni-Holm Adjusted P-value = 0.033031901504932966
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 80.5, Bonferroni-Holm Adjusted P-value = 0.010315235916655908
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 118.0, Bonferroni-Holm Adjusted P-value = 0.0524344350389842
5. Pure being and pure awareness ($0 = \text{none to}$

10 = strongest imaginable): U-statistic = 80.5, Bonferroni-Holm Adjusted P-value = 0.010315235916655908
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): U-statistic = 79.0, Bonferroni-Holm Adjusted P-value = 0.010315235916655908
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): U-statistic = 60.0, Bonferroni-Holm Adjusted P-value = 0.0015029295099131235
8. Timelessness (0 = none to 10 = strongest imaginable): U-statistic = 48.5, Bonferroni-Holm Adjusted P-value = 0.00046003734232694224
9. Ineffability (0 = none to 10 = strongest imaginable): U-statistic = 91.5, Bonferroni-Holm Adjusted P-value = 0.02361060472165784
10. Feelings of joy (0 = none to 10 = strongest imaginable): U-statistic = 111.0, Bonferroni-Holm Adjusted P-value = 0.048056561174629205
11. Feelings of peace and tranquility (0 = none to 10 = strongest imaginable): U-statistic = 100.5, Bonferroni-Holm Adjusted P-value = 0.033031901504932966
12. Positive Emotional Valence (0 = none to 10 = strongest imaginable): U-statistic = 98.0, Bonferroni-Holm Adjusted P-value = 0.033031901504932966
13. Negative emotional valence (0 = none to 10 = strongest imaginable): U-statistic = 197.0, Bonferroni-Holm Adjusted P-value = 0.9530838570772034

Results for Timepoint 300 (minutes):

1. Overall Psilocybin Effect (0 = none to 10 = strongest imaginable): U-statistic = 9.5, Bonferroni-Holm Adjusted P-value = 1.10682842882081e-06
2. Now-ness (0 = none to 10 = strongest imaginable): U-statistic = 88.0, Bonferroni-Holm Adjusted P-value = 0.01390716803017889
3. Letting Go (0 = none to 10 = strongest imaginable): U-statistic = 65.5, Bonferroni-Holm Adjusted P-value = 0.0027091104313635536
4. Equanimity (0 = none to 10 = strongest imaginable): U-statistic = 81.5, Bonferroni-Holm Adjusted P-value = 0.008918872394915131
5. Pure being and pure awareness (0 = none to 10 = strongest imaginable): U-statistic = 79.0, Bonferroni-Holm Adjusted P-value = 0.008729585051275402
6. Fusion of your personal self into a larger whole (0 = none to 10 = strongest imaginable): U-statistic = 67.5, Bonferroni-Holm Adjusted P-value = 0.003249273623837862
7. Sense of reverence or sacredness (0 = none to 10 = strongest imaginable): U-statistic = 58.0, Bonferroni-Holm Adjusted P-value = 0.0013742212344798471
8. Timelessness (0 = none to 10 = strongest imaginable): U-statistic = 110.5, Bonferroni-Holm Adjusted P-value = 0.031708448863468144
9. Ineffability (0 = none to 10 = strongest imaginable): U-statistic = 104.0, Bonferroni-Holm Adjusted P-value = 0.028583838565360203

10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 90.5, Bonferroni-Holm Adjusted P-value = 0.01390716803017889
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 89.0, Bonferroni-Holm Adjusted P-value = 0.01390716803017889
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 76.5, Bonferroni-Holm Adjusted P-value = 0.007168531202515703
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 211.5, Bonferroni-Holm Adjusted P-value = 0.7367868663572368

Results for Timepoint 360 (minutes):

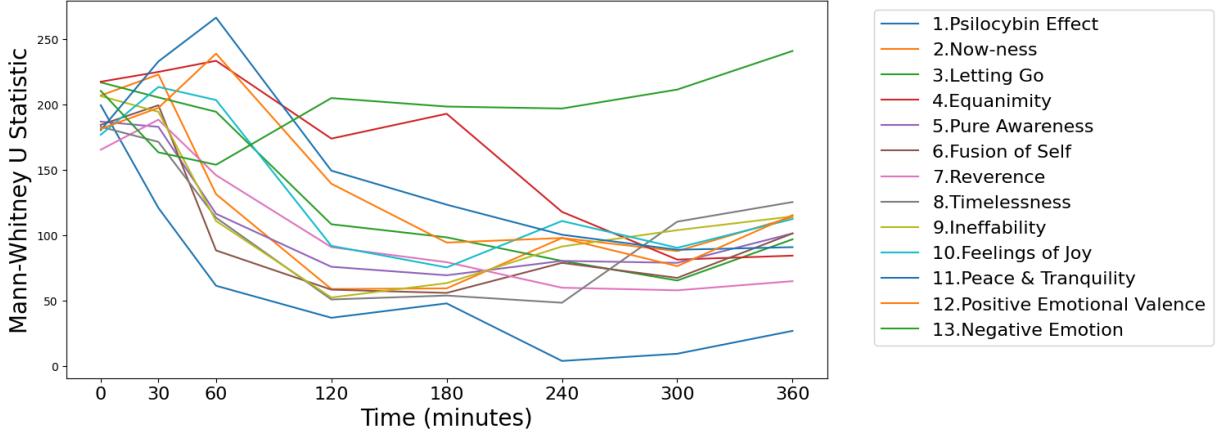
1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 27.0, Bonferroni-Holm Adjusted P-value = 1.2284320112470944e-05
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 114.0, Bonferroni-Holm Adjusted P-value = 0.1081315516208195
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 97.0, Bonferroni-Holm Adjusted P-value = 0.04721497772796084
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 84.5, Bonferroni-Holm Adjusted P-value = 0.018780266333071054
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 101.5, Bonferroni-Holm Adjusted P-value = 0.06287103683580139
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 101.5, Bonferroni-Holm Adjusted P-value = 0.06287103683580139
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 65.0, Bonferroni-Holm Adjusted P-value = 0.00298832704993399
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 125.5, Bonferroni-Holm Adjusted P-value = 0.1081315516208195
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 114.5, Bonferroni-Holm Adjusted P-value = 0.1081315516208195
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 112.5, Bonferroni-Holm Adjusted P-value = 0.1081315516208195
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 91.0, Bonferroni-Holm Adjusted P-value = 0.030950486137314593
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 115.5, Bonferroni-Holm Adjusted P-value = 0.1081315516208195
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 241.0, Bonferroni-Holm Adjusted P-value = 0.21908418677908803

```
In [194...]: mann_u_stats_psilo_pla = {col: [mannwhitney_results_by_time_psilo_pla[timepoint][col] for timepoint in rating_columns], "Time": timepoints}
mann_u_p_values_psilo_pla = {col: [mannwhitney_results_by_time_psilo_pla[timepoint][col] for timepoint in rating_columns], "Time": timepoints}

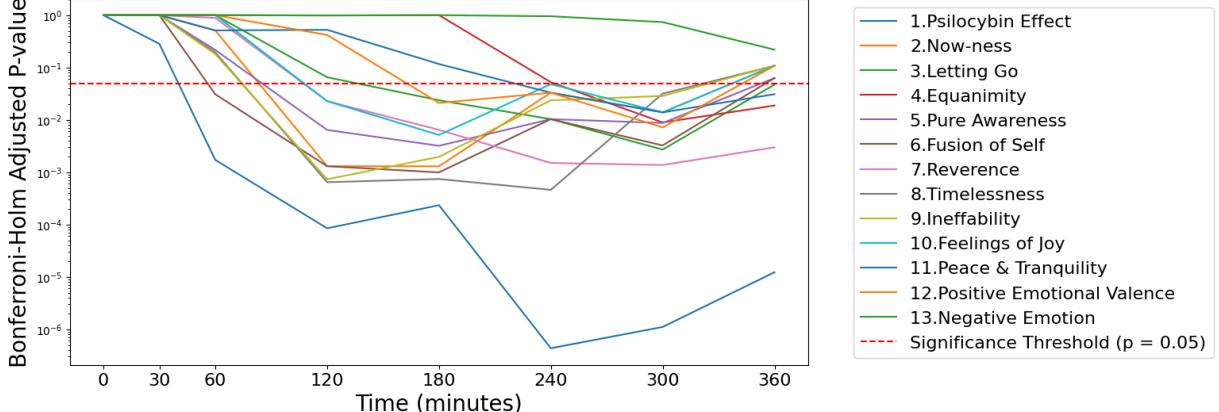
plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, mann_u_stats_psilo_pla[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Mann-Whitney U Statistic', fontsize=20)
plt.xticks([0, 30, 60, 120, 180, 240, 300, 360], fontsize=16)
plt.title('Mann-Whitney U Statistics Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1)', fontsize=16)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize=16)
plt.show()

plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, mann_u_p_values_psilo_pla[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Bonferroni-Holm Adjusted P-value', fontsize=20)
plt.xticks([0, 30, 60, 120, 180, 240, 300, 360], fontsize=16)
plt.title('Adjusted P-values Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1)', fontsize=16)
plt.axhline(y=0.05, color='r', linestyle='--', label='Significance Threshold (p = 0.05)')
plt.yscale('log')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize=16)
plt.show()
```

Mann-Whitney U Statistics Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1)



Adjusted P-values Over Time: Psilocybin (Sec 1) vs Placebo (Sec 1)



Section for Mann U Test for Psilocybin (Sec 1) vs Psilocybin (Sec 2)

```
In [113...]:
```

```

for timepoint in timepoints:
    df_timepoint = df_cleaned_imputed[
        df_cleaned_imputed['Timepoint relative to drug administration (in minutes)']
    ]

    psilocybin_scores_sec1 = df_timepoint[
        (df_timepoint['Condition (PLA: placebo, EXP: 25 mg/70 kg psilocybi)'] == 'PSIL'
         (df_timepoint['Session (1, 2)'] == 1)
    ][rating_columns]

    psilocybin_scores_sec2 = df_timepoint[
        (df_timepoint['Condition (PLA: placebo, EXP: 25 mg/70 kg psilocybi)'] == 'EXP'
         (df_timepoint['Session (1, 2)'] == 2)
    ][rating_columns]

    mannwhitney_results_by_time_psilo_both[timepoint] = {}
    mannwhitney_p_values = []
    mannwhitney_test_stats = []

    print(f"Timepoint {timepoint}:")
    print(f"  Number of observations in psilocybin_scores_sec1: {len(psilocybin_scores_sec1)}")
    print(f"  Number of observations in psilocybin_scores_sec2: {len(psilocybin_scores_sec2)}")

    for col in rating_columns:
        try:
            u_stat, p_value = mannwhitneyu(
                psilocybin_scores_sec1[col], psilocybin_scores_sec2[col], alternative='two-sided')
        except ValueError:
            mannwhitney_p_values.append(np.nan)
            mannwhitney_test_stats.append(None)

        valid_mask = ~np.isnan(mannwhitney_p_values)
        adjusted_p_values = np.full(len(mannwhitney_p_values), np.nan)
        if valid_mask.any():
            adjusted_p_values[valid_mask] = multipletests(
                np.array(mannwhitney_p_values)[valid_mask], alpha=0.05, method='holm')[1]

        for col, u_stat, adj_p_value in zip(rating_columns, mannwhitney_test_stats, adjusted_p_values):
            mannwhitney_results_by_time_psilo_both[timepoint][col] = (u_stat, adj_p_value)

    print(f"Results for Timepoint {timepoint} (minutes):")
    for col, (u_stat, adj_p_value) in mannwhitney_results_by_time_psilo_both[timepoint].items():
        print(f"{col}: U-statistic = {u_stat}, Bonferroni-Holm Adjusted P-value = {adj_p_value}")
    print("\n")

```

Timepoint 0:

Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21
Results for Timepoint 0 (minutes):
1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 199.5, Bonferroni-Holm Adjusted P-value = 1.0
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 203.0, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 171.5, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 160.5, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 222.5, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 224.5, Bonferroni-Holm Adjusted P-value = 1.0
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 237.0, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 214.0, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 214.0, Bonferroni-Holm Adjusted P-value = 1.0
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 194.0, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 211.5, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 211.0, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 233.0, Bonferroni-Holm Adjusted P-value = 1.0

Timepoint 30:

Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21
Results for Timepoint 30 (minutes):
1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 169.5, Bonferroni-Holm Adjusted P-value = 1.0
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 197.5, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$

```
10 = strongest imaginable): U-statistic = 183.5, Bonferroni-Holm Adjusted P-value =
1.0
4. Equanimity ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 180.0, Bonferroni-Holm Adjusted P-value =
1.0
5. Pure being and pure awareness ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 219.0, Bonferroni-Holm Adjusted P-value =
1.0
6. Fusion of your personal self into a larger whole ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 214.5, Bonferroni-Holm Adjusted P-value =
1.0
7. Sense of reverence or sacredness ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 214.0, Bonferroni-Holm Adjusted P-value =
1.0
8. Timelessness ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 214.0, Bonferroni-Holm Adjusted P-value =
1.0
9. Ineffability ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 144.0, Bonferroni-Holm Adjusted P-value =
1.0
10. Feelings of joy ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 177.0, Bonferroni-Holm Adjusted P-value =
1.0
11. Feelings of peace and tranquility ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 192.5, Bonferroni-Holm Adjusted P-value =
1.0
12. Positive Emotional Valence ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 208.5, Bonferroni-Holm Adjusted P-value =
1.0
13. Negative emotional valence ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 232.0, Bonferroni-Holm Adjusted P-value =
1.0
```

Timepoint 60:

```
Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21
```

Results for Timepoint 60 (minutes):

```
1. Overall Psilocybin Effect ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 160.0, Bonferroni-Holm Adjusted P-value =
1.0
2. Now-ness ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 234.0, Bonferroni-Holm Adjusted P-value =
1.0
3. Letting Go ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 194.5, Bonferroni-Holm Adjusted P-value =
1.0
4. Equanimity ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 191.5, Bonferroni-Holm Adjusted P-value =
1.0
5. Pure being and pure awareness ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 235.5, Bonferroni-Holm Adjusted P-value =
1.0
6. Fusion of your personal self into a larger whole ( $\theta$  = none to
10 = strongest imaginable): U-statistic = 232.0, Bonferroni-Holm Adjusted P-value =
1.0
```

7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 245.5, Bonferroni-Holm Adjusted P-value =
1.0

8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 246.5, Bonferroni-Holm Adjusted P-value =
1.0

9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 160.0, Bonferroni-Holm Adjusted P-value =
1.0

10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 166.0, Bonferroni-Holm Adjusted P-value =
1.0

11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 205.5, Bonferroni-Holm Adjusted P-value =
1.0

12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 158.5, Bonferroni-Holm Adjusted P-value =
1.0

13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 221.0, Bonferroni-Holm Adjusted P-value =
1.0

Timepoint 120:

Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21

Results for Timepoint 120 (minutes):

1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 188.0, Bonferroni-Holm Adjusted P-value =
1.0

2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 214.0, Bonferroni-Holm Adjusted P-value =
1.0

3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 189.0, Bonferroni-Holm Adjusted P-value =
1.0

4. Equanimity ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 202.0, Bonferroni-Holm Adjusted P-value =
1.0

5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 229.5, Bonferroni-Holm Adjusted P-value =
1.0

6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 222.0, Bonferroni-Holm Adjusted P-value =
1.0

7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 215.0, Bonferroni-Holm Adjusted P-value =
1.0

8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 212.5, Bonferroni-Holm Adjusted P-value =
1.0

9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 182.0, Bonferroni-Holm Adjusted P-value =
1.0

10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 206.5, Bonferroni-Holm Adjusted P-value =

1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): U-statistic = 223.0, Bonferroni-Holm Adjusted P-value =
1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): U-statistic = 184.0, Bonferroni-Holm Adjusted P-value =
1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): U-statistic = 193.0, Bonferroni-Holm Adjusted P-value =
1.0

Timepoint 180:

Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21

Results for Timepoint 180 (minutes):

1. Overall Psilocybin Effect (0 = none to
10 = strongest imaginable): U-statistic = 133.0, Bonferroni-Holm Adjusted P-value =
0.47268462220044233
2. Now-ness (0 = none to
10 = strongest imaginable): U-statistic = 135.0, Bonferroni-Holm Adjusted P-value =
0.6240019292323085
3. Letting Go (0 = none to
10 = strongest imaginable): U-statistic = 160.5, Bonferroni-Holm Adjusted P-value =
1.0
4. Equanimity (0 = none to
10 = strongest imaginable): U-statistic = 107.5, Bonferroni-Holm Adjusted P-value =
0.14285054652367374
5. Pure being and pure awareness (0 = none to
10 = strongest imaginable): U-statistic = 203.5, Bonferroni-Holm Adjusted P-value =
1.0
6. Fusion of your personal self into a larger whole (0 = none to
10 = strongest imaginable): U-statistic = 198.0, Bonferroni-Holm Adjusted P-value =
1.0
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): U-statistic = 172.0, Bonferroni-Holm Adjusted P-value =
1.0
8. Timelessness (0 = none to
10 = strongest imaginable): U-statistic = 187.0, Bonferroni-Holm Adjusted P-value =
1.0
9. Ineffability (0 = none to
10 = strongest imaginable): U-statistic = 144.0, Bonferroni-Holm Adjusted P-value =
1.0
10. Feelings of joy (0 = none to
10 = strongest imaginable): U-statistic = 176.0, Bonferroni-Holm Adjusted P-value =
1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): U-statistic = 193.5, Bonferroni-Holm Adjusted P-value =
1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): U-statistic = 177.0, Bonferroni-Holm Adjusted P-value =
1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): U-statistic = 214.0, Bonferroni-Holm Adjusted P-value =
1.0

Timepoint 240:

Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21
Results for Timepoint 240 (minutes):
1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 199.5, Bonferroni-Holm Adjusted P-value = 1.0
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 182.5, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 178.0, Bonferroni-Holm Adjusted P-value = 1.0
4. EQUANIMITY ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 177.0, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 174.0, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 211.5, Bonferroni-Holm Adjusted P-value = 1.0
7. Sense of reverence or sacredness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 201.0, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 216.0, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 152.0, Bonferroni-Holm Adjusted P-value = 1.0
10. Feelings of joy ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 166.0, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 174.5, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 180.5, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 228.0, Bonferroni-Holm Adjusted P-value = 1.0

Timepoint 300:

Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21
Results for Timepoint 300 (minutes):
1. Overall Psilocybin Effect ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 207.5, Bonferroni-Holm Adjusted P-value = 1.0
2. Now-ness ($\theta = \text{none to}$
 $10 = \text{strongest imaginable}$): U-statistic = 219.0, Bonferroni-Holm Adjusted P-value = 1.0

3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 259.5, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 238.0, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 242.0, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 251.5, Bonferroni-Holm Adjusted P-value = 1.0
7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 245.0, Bonferroni-Holm Adjusted P-value = 1.0
8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 210.5, Bonferroni-Holm Adjusted P-value = 1.0
9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 187.0, Bonferroni-Holm Adjusted P-value = 1.0
10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 197.0, Bonferroni-Holm Adjusted P-value = 1.0
11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 225.0, Bonferroni-Holm Adjusted P-value = 1.0
12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 225.5, Bonferroni-Holm Adjusted P-value = 1.0
13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 180.5, Bonferroni-Holm Adjusted P-value = 1.0

Timepoint 360:

Number of observations in psilocybin_scores_sec1: 19
Number of observations in psilocybin_scores_sec2: 21

Results for Timepoint 360 (minutes):

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 214.0, Bonferroni-Holm Adjusted P-value = 1.0
2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 235.0, Bonferroni-Holm Adjusted P-value = 1.0
3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 228.5, Bonferroni-Holm Adjusted P-value = 1.0
4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 235.0, Bonferroni-Holm Adjusted P-value = 1.0
5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 214.0, Bonferroni-Holm Adjusted P-value = 1.0
6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: U-statistic = 216.5, Bonferroni-Holm Adjusted P-value =

```

1.0
7. Sense of reverence or sacredness (0 = none to
10 = strongest imaginable): U-statistic = 236.0, Bonferroni-Holm Adjusted P-value =
1.0
8. Timelessness (0 = none to
10 = strongest imaginable): U-statistic = 192.0, Bonferroni-Holm Adjusted P-value =
1.0
9. Ineffability (0 = none to
10 = strongest imaginable): U-statistic = 146.0, Bonferroni-Holm Adjusted P-value =
1.0
10. Feelings of joy (0 = none to
10 = strongest imaginable): U-statistic = 181.5, Bonferroni-Holm Adjusted P-value =
1.0
11. Feelings of peace and tranquility (0 = none to
10 = strongest imaginable): U-statistic = 254.5, Bonferroni-Holm Adjusted P-value =
1.0
12. Positive Emotional Valence (0 = none to
10 = strongest imaginable): U-statistic = 203.5, Bonferroni-Holm Adjusted P-value =
1.0
13. Negative emotional valence (0 = none to
10 = strongest imaginable): U-statistic = 180.0, Bonferroni-Holm Adjusted P-value =
1.0

```

In [196...]

```

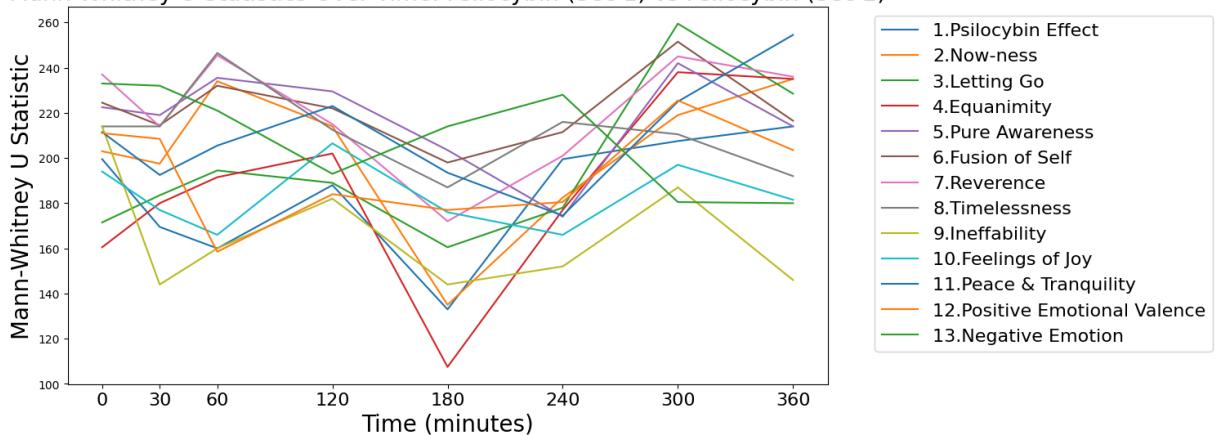
mann_u_stats_psilo_both = {col: [mannwhitney_results_by_time_psilo_both[timepoint][
mann_u_p_values_psilo_both = {col: [mannwhitney_results_by_time_psilo_both[timepoint][

plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, mann_u_stats_psilo_both[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Mann-Whitney U Statistic', fontsize=20)
plt.xticks([0, 30, 60, 120, 180, 240, 300, 360], fontsize=16)
plt.title('Mann-Whitney U Statistics Over Time: Psilocybin (Sec 1) vs Psilocybin (S
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize=16)
plt.show()

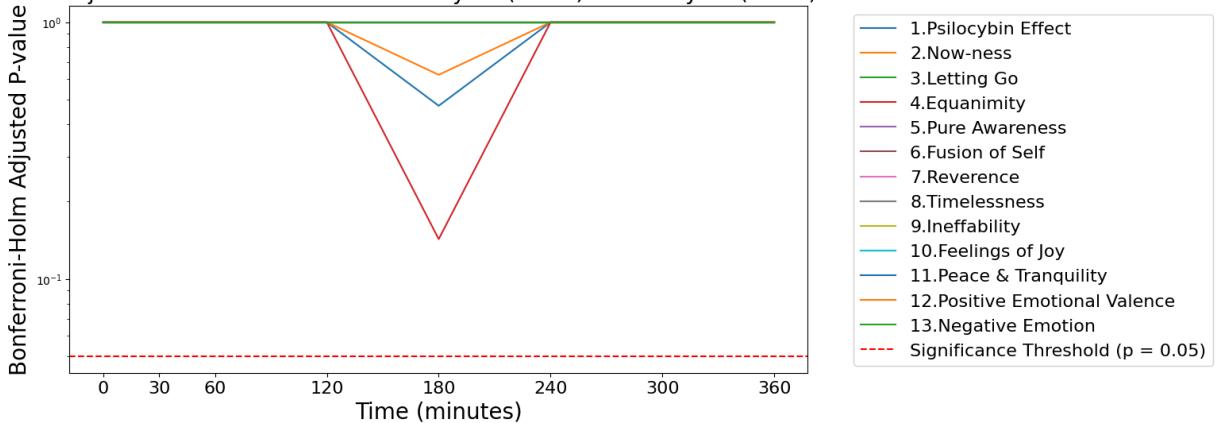
plt.figure(figsize=(12, 6))
for col, short_col in zip(rating_columns, shortened_rating_columns):
    plt.plot(timepoints, mann_u_p_values_psilo_both[col], label=short_col)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Bonferroni-Holm Adjusted P-value', fontsize=20)
plt.xticks([0, 30, 60, 120, 180, 240, 300, 360], fontsize=16)
plt.title('Adjusted P-values Over Time: Psilocybin (Sec 1) vs Psilocybin (Sec 2)', f
plt.axhline(y=0.05, color='r', linestyle='--', label='Significance Threshold (p = 0
plt.yscale('log')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', fontsize=16)
plt.show()

```

Mann-Whitney U Statistics Over Time: Psilocybin (Sec 1) vs Psilocybin (Sec 2)



Adjusted P-values Over Time: Psilocybin (Sec 1) vs Psilocybin (Sec 2)



Heatmap comparing Wilcoxon and Independent T-statistic

```
In [266]: mann_u_p_values_psilo_pla = {col: [mannwhitney_results_by_time_psilo_pla[timepoint]
wilcoxon_p_values_psilo_pla = {col: [wilcoxon_results_by_time_psilo_pla[timepoint][
mann_u_p_values_psilo_both = {col: [mannwhitney_results_by_time_psilo_both[timepoint]

mann_u_p_values_psilo_pla_df = pd.DataFrame(mann_u_p_values_psilo_pla, index=timepoints)
wilcoxon_p_values_psilo_pla_df = pd.DataFrame(wilcoxon_p_values_psilo_pla, index=timepoints)
mann_u_p_values_psilo_both_df = pd.DataFrame(mann_u_p_values_psilo_both, index=timepoints)

mann_u_p_values_psilo_pla_log = -np.log10(mann_u_p_values_psilo_pla_df)
wilcoxon_p_values_psilo_pla_log = -np.log10(wilcoxon_p_values_psilo_pla_df)
mann_u_p_values_psilo_both_log = -np.log10(mann_u_p_values_psilo_both_df)

plt.figure(figsize=(18, 6))
significance_threshold = -np.log10(0.05)# -log10(0.05)

plt.subplot(1, 3, 1)
ax1 = sns.heatmap(mann_u_p_values_psilo_pla_log, cmap='Blues', annot=False, cbar_kws={})
plt.title('Mann-Whitney U: Placebo (Sec 1) vs. Psilocybin (Sec 1)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Question', fontsize=20)
plt.yticks(ticks=np.arange(len(shortened_rating_columns)) + 0.5, labels=shortened_rating_columns)

plt.subplot(1, 3, 2)
ax2 = sns.heatmap(wilcoxon_p_values_psilo_pla_log, cmap='Blues', annot=False, cbar_kws={})
plt.title('Wilcoxon: Placebo (Sec 1) vs. Psilocybin (Sec 1)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Question', fontsize=20)
plt.yticks(ticks=np.arange(len(shortened_rating_columns)) + 0.5, labels=shortened_rating_columns)

plt.subplot(1, 3, 3)
ax3 = sns.heatmap(mann_u_p_values_psilo_both_log, cmap='Blues', annot=False, cbar_kws={})
plt.title('Mann-Whitney U: Both vs. Placebo (Sec 1)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Question', fontsize=20)
plt.yticks(ticks=np.arange(len(shortened_rating_columns)) + 0.5, labels=shortened_rating_columns)
```

```

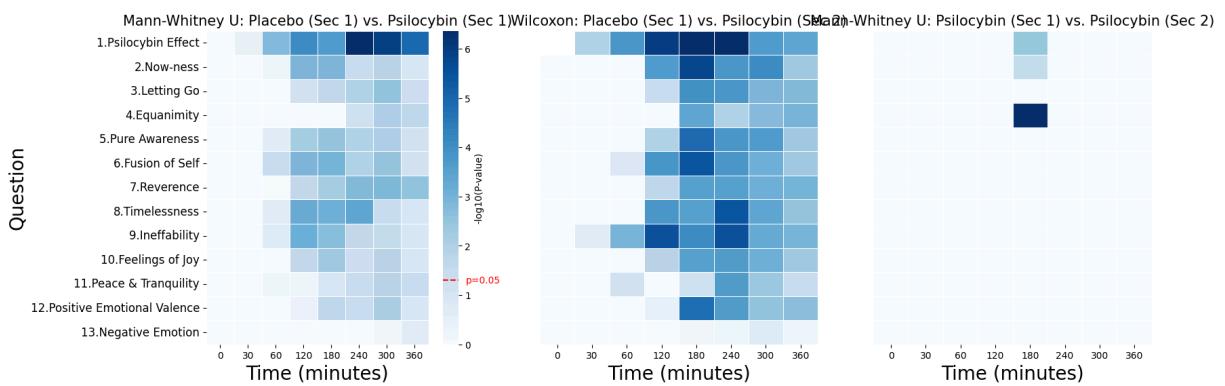
cbar = ax1.collections[0].colorbar
cbar.ax.axhline(y=significance_threshold, color='red', linestyle='--', linewidth=1)
cbar.ax.text(1.5, significance_threshold, 'p=0.05', color='red', va='center')

plt.subplot(1, 3, 2)
ax2 = sns.heatmap(wilcoxon_p_values_psilo_pla_log, cmap='Blues', annot=False, cbar=False)
plt.title('Wilcoxon: Placebo (Sec 1) vs. Psilocybin (Sec 2)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.yticks([])

plt.subplot(1, 3, 3)
ax3 = sns.heatmap(mann_u_p_values_psilo_both_log, cmap='Blues', annot=False, cbar=False)
plt.title('Mann-Whitney U: Psilocybin (Sec 1) vs. Psilocybin (Sec 2)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.yticks([])

plt.show()

```



Heatmap in a different color (coolwarm)

```

In [268...]: plt.figure(figsize=(18, 6))
significance_threshold = -np.log10(0.05)# -log10(0.05)

plt.subplot(1, 3, 1)
ax1 = sns.heatmap(mann_u_p_values_psilo_pla_log, cmap='coolwarm', annot=False, cbar=False)
plt.title('Mann-Whitney U: Placebo (Sec 1) vs. Psilocybin (Sec 1)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.ylabel('Question', fontsize=20)
plt.yticks(ticks=np.arange(len(shortened_rating_columns)) + 0.5, labels=shortened_r

cbar = ax1.collections[0].colorbar
cbar.ax.axhline(y=significance_threshold, color='red', linestyle='--', linewidth=1)
cbar.ax.text(1.5, significance_threshold, 'p=0.05', color='red', va='center')

plt.subplot(1, 3, 2)
ax2 = sns.heatmap(wilcoxon_p_values_psilo_pla_log, cmap='coolwarm', annot=False, cbar=False)
plt.title('Wilcoxon: Placebo (Sec 1) vs. Psilocybin (Sec 2)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.yticks([])

plt.show()

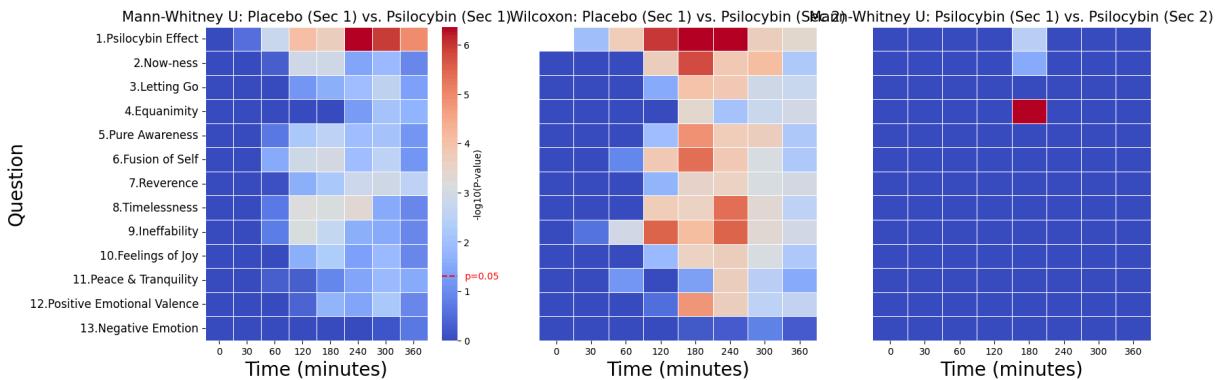
```

```

plt.subplot(1, 3, 3)
ax3 = sns.heatmap(mann_u_p_values_psilo_both_log, cmap='coolwarm', annot=False, cbar=False)
plt.title('Mann-Whitney U: Psilocybin (Sec 1) vs. Psilocybin (Sec 2)', fontsize=15)
plt.xlabel('Time (minutes)', fontsize=20)
plt.yticks([])

plt.show()

```



Data Exploration

```

In [33]: for timepoint in timepoints:
    # Filter data for the current timepoint and section 1
    df_timepoint = df_cleaned[df_cleaned['Timepoint relative to drug administration'] == timepoint]

    df_placebo = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg/70 kg)'] == 'placebo')]
    df_exp = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg/70 kg)'] == 'exp')]

    placebo_means = df_placebo[rating_columns].mean()
    exp_means = df_exp[rating_columns].mean()

    # Create a bar plot
    x = np.arange(len(rating_columns)) # the label locations
    width = 0.35 # the width of the bars

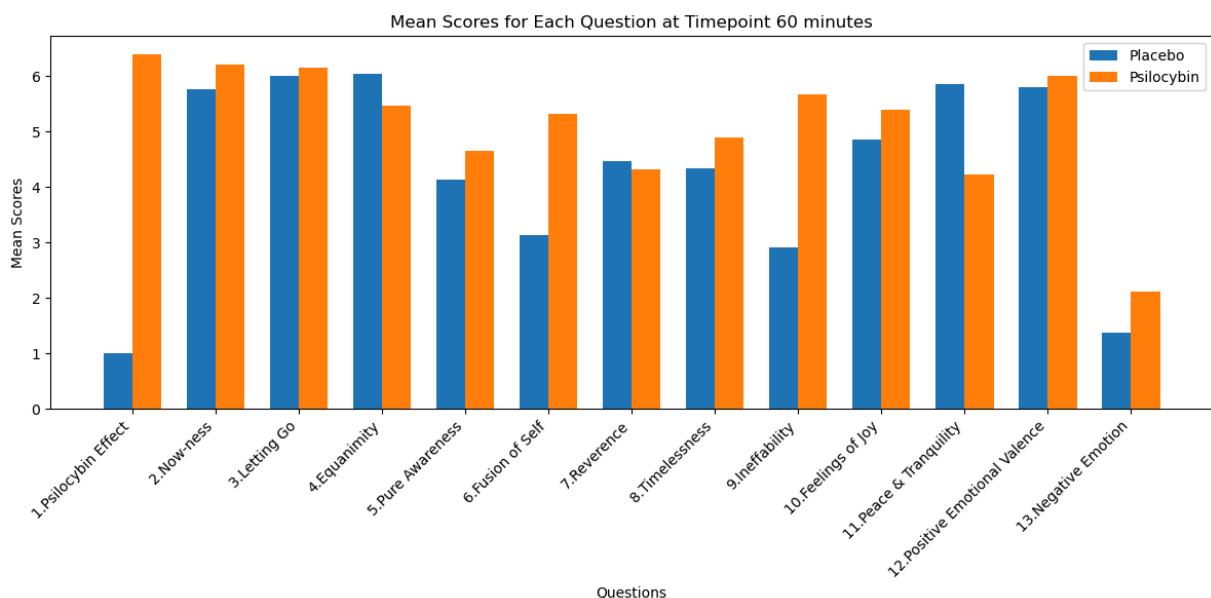
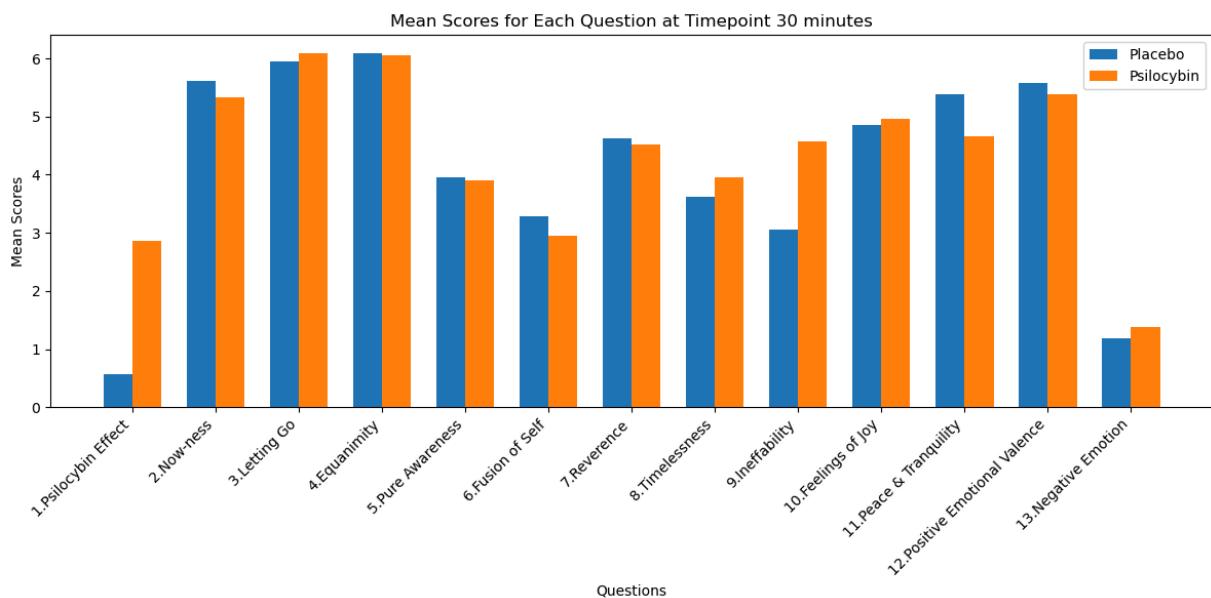
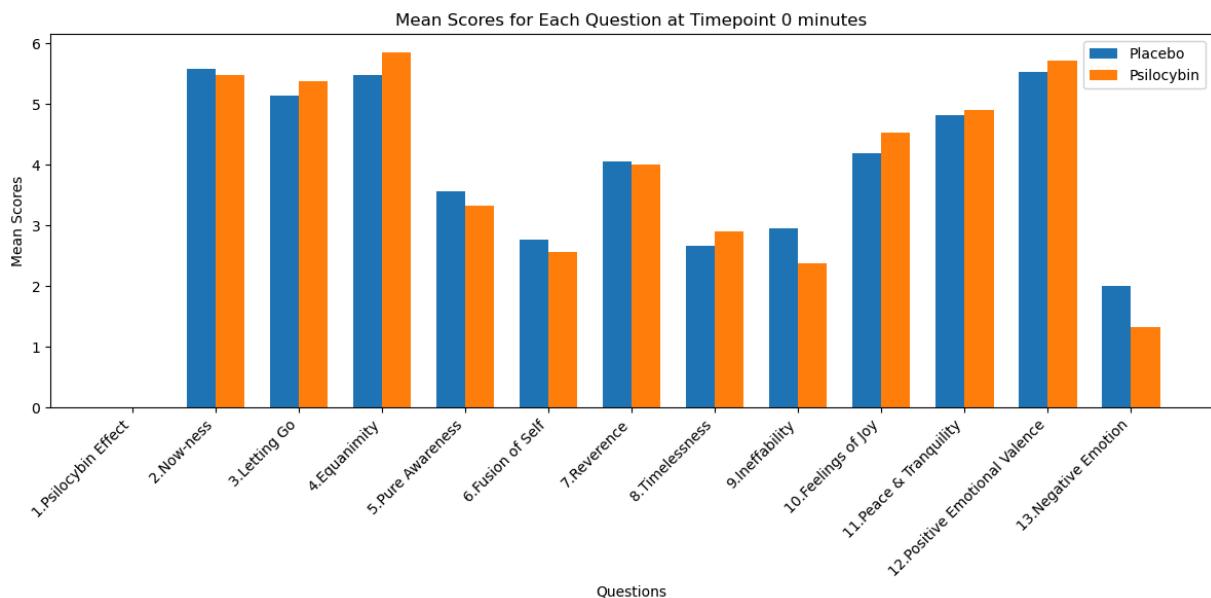
    fig, ax = plt.subplots(figsize=(12, 6))

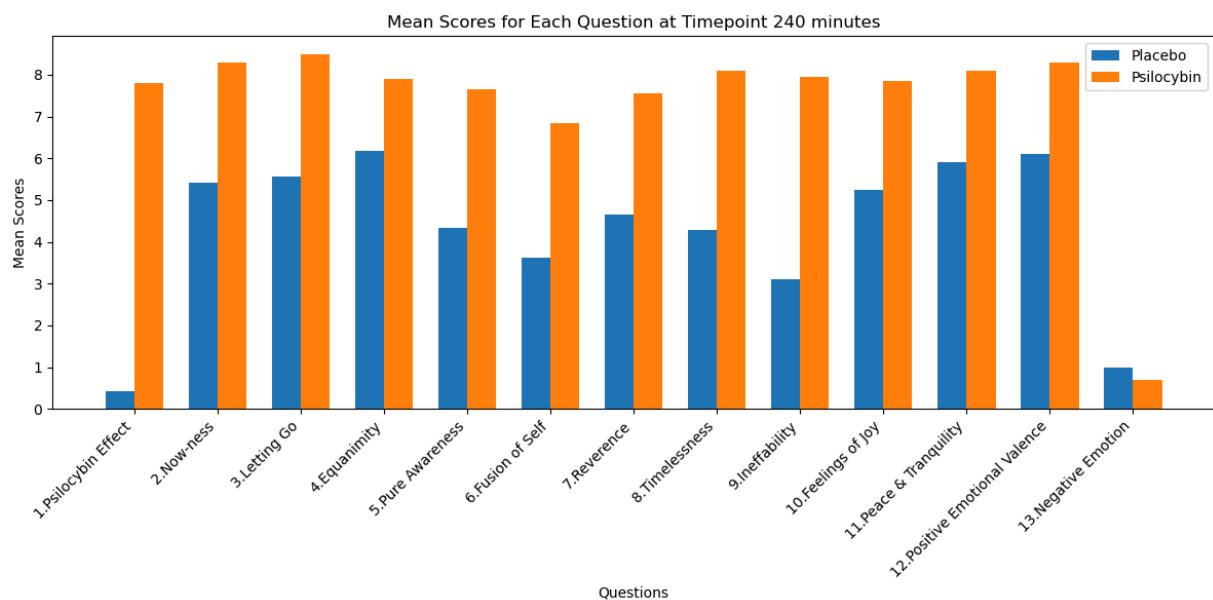
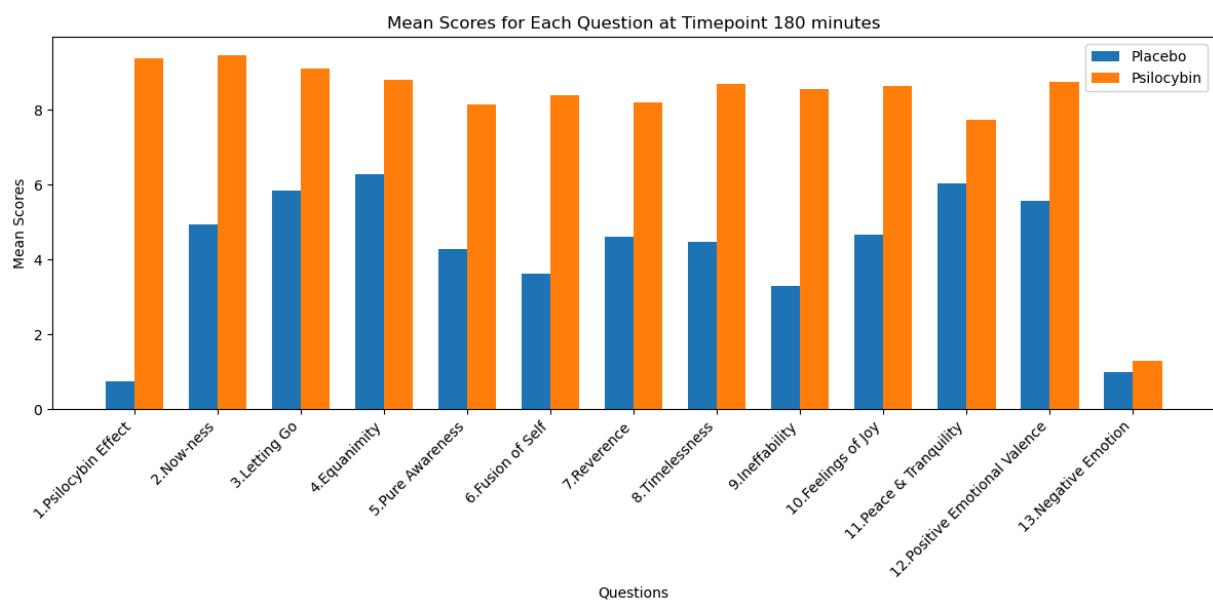
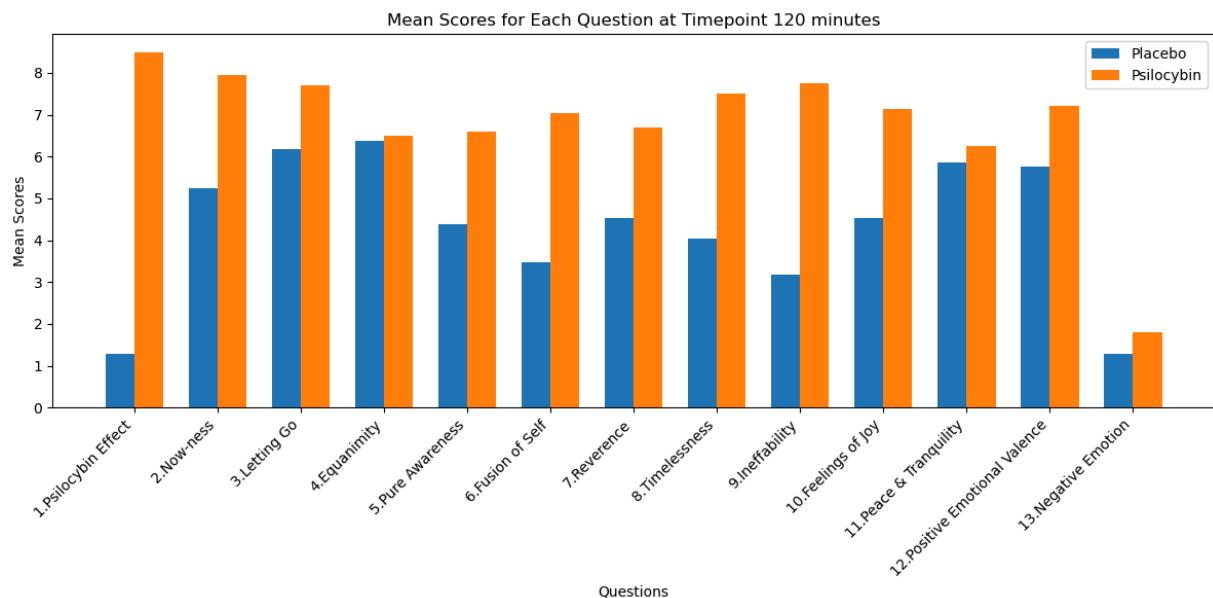
    # Bar plot for placebo and psilocybin
    ax.bar(x - width/2, placebo_means, width, label='Placebo')
    ax.bar(x + width/2, exp_means, width, label='Psilocybin')

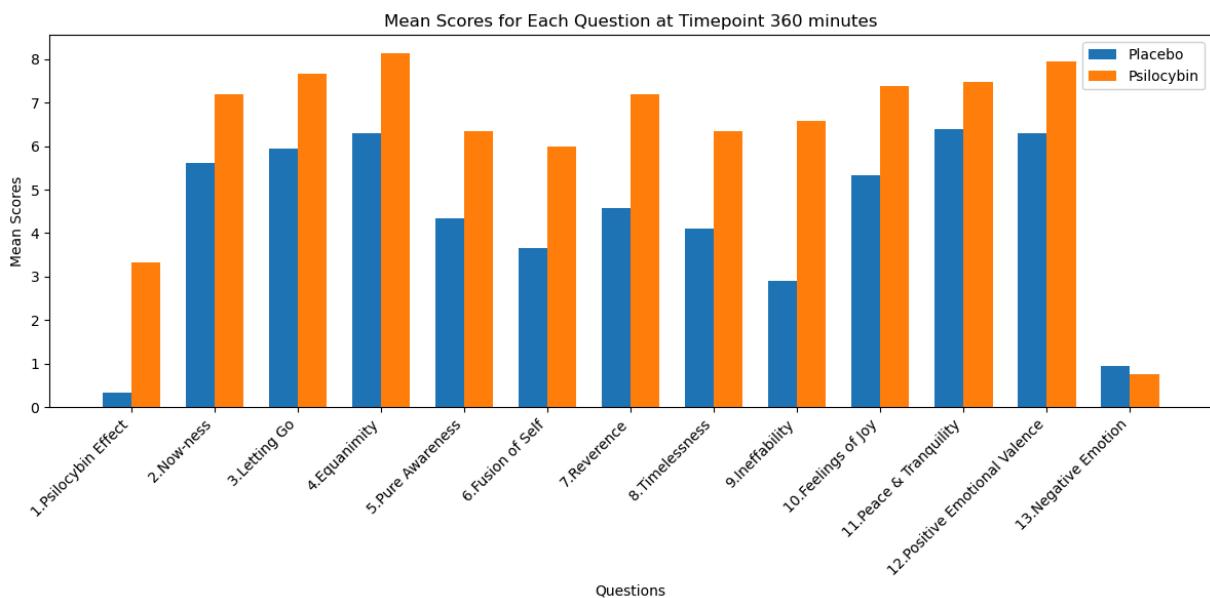
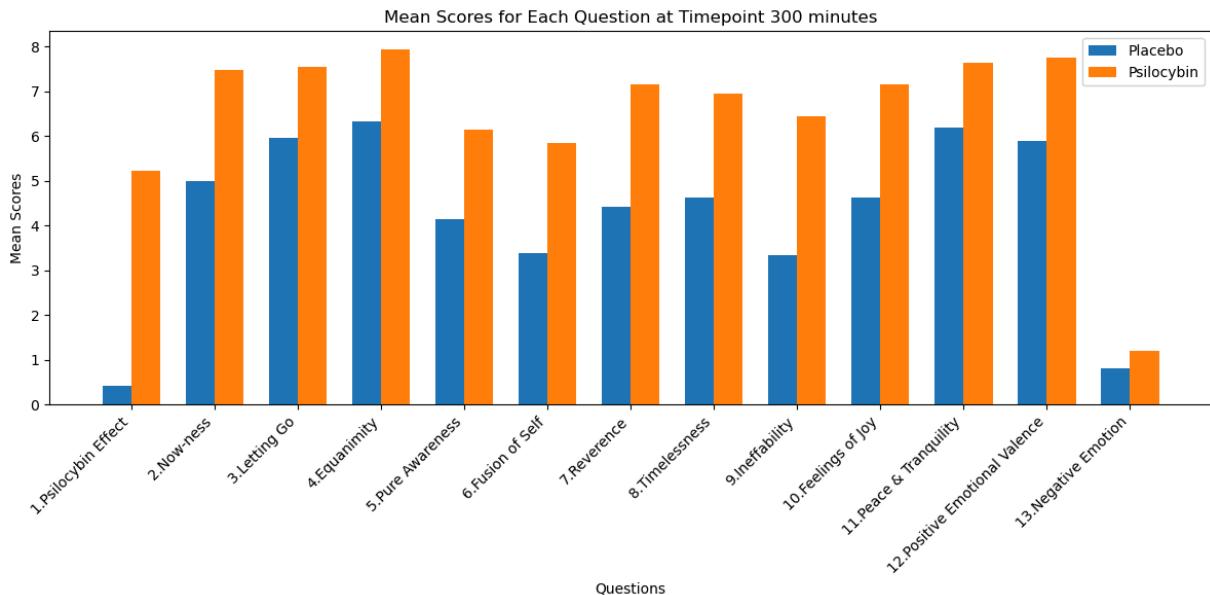
    # Add labels, title, and custom x-axis tick labels
    ax.set_xlabel('Questions')
    ax.set_ylabel('Mean Scores')
    ax.set_title(f'Mean Scores for Each Question at Timepoint {timepoint} minutes')
    ax.set_xticks(x)
    ax.set_xticklabels(shortened_rating_columns, rotation=45, ha='right')
    ax.legend()

    fig.tight_layout()
    plt.show()

```







```
In [34]: for timepoint in timepoints:
    df_timepoint = df_cleaned[df_cleaned['Timepoint relative to drug administration'] == timepoint]
    df_placebo = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg/70 mg)'] == 'placebo')]
    df_psilocybin = df_timepoint[(df_timepoint['Condition (PLA: placebo, EXP: 25 mg/70 mg)'] == 'psilocybin')]

    placebo_means = df_placebo[rating_columns].mean()
    psilocybin_means = df_psilocybin[rating_columns].mean()

    x = np.arange(len(rating_columns))
    width = 0.35

    fig, ax = plt.subplots(figsize=(12, 6))

    ax.bar(x - width/2, placebo_means, width, label='Placebo')
    ax.bar(x + width/2, psilocybin_means, width, label='Psilocybin')

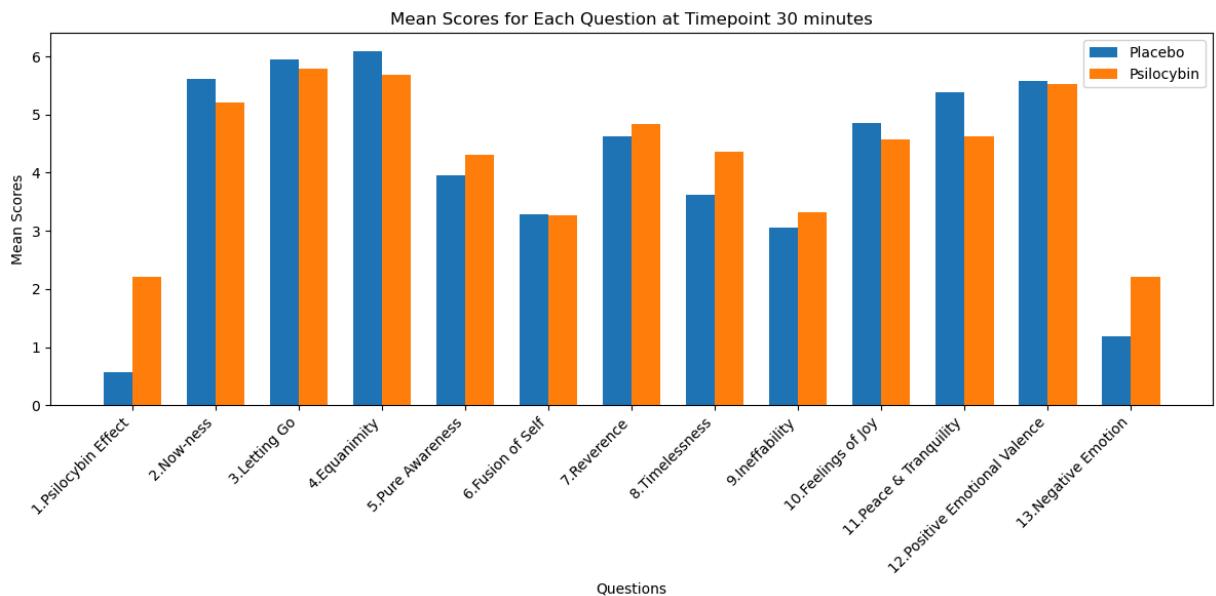
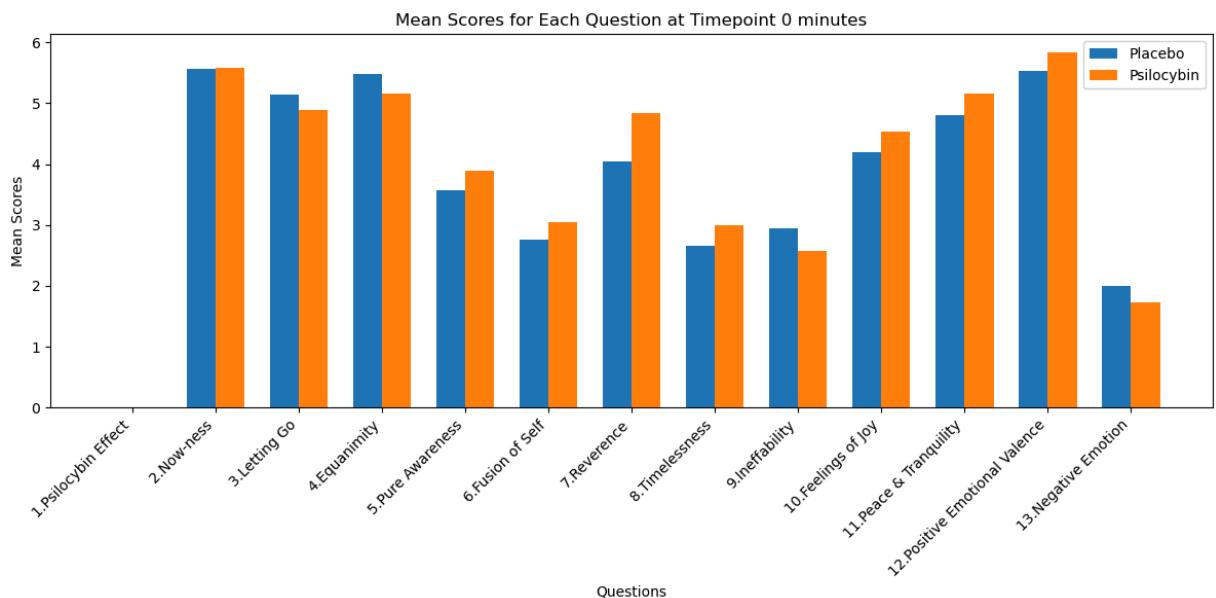
    ax.set_xlabel('Questions')
    ax.set_ylabel('Mean Scores')
    ax.set_title(f'Mean Scores for Each Question at Timepoint {timepoint} minutes')
```

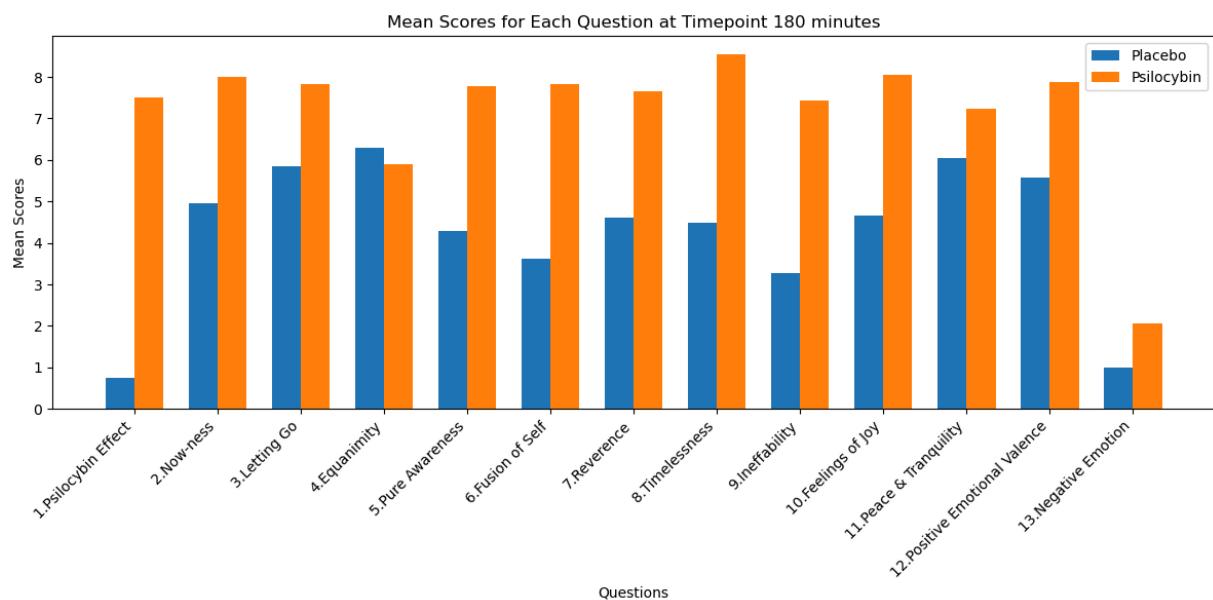
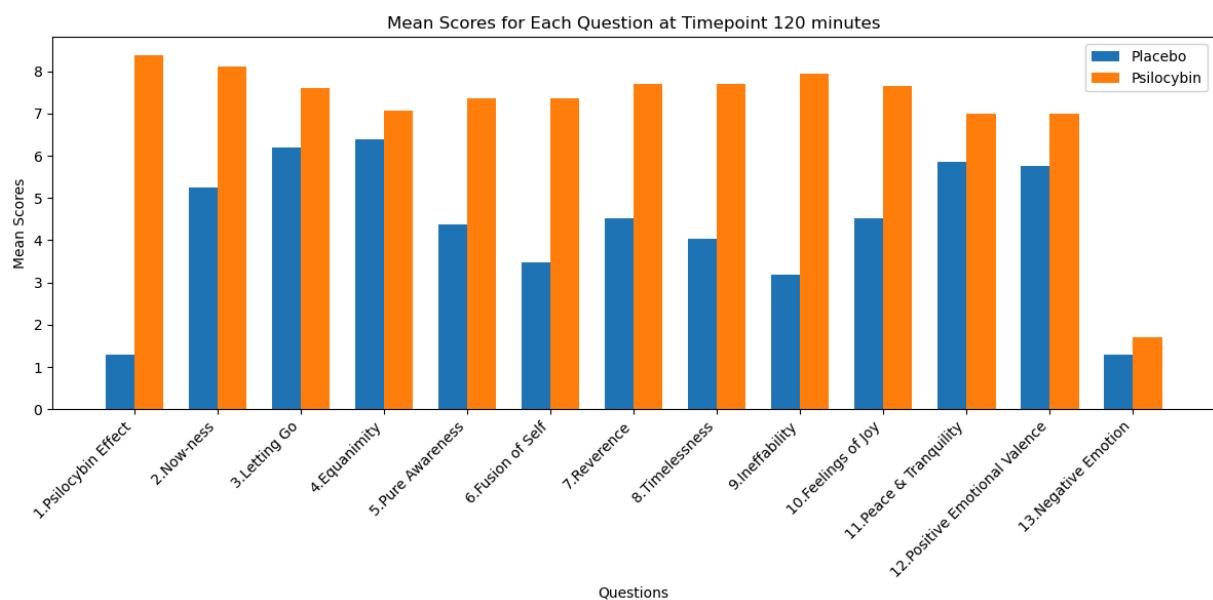
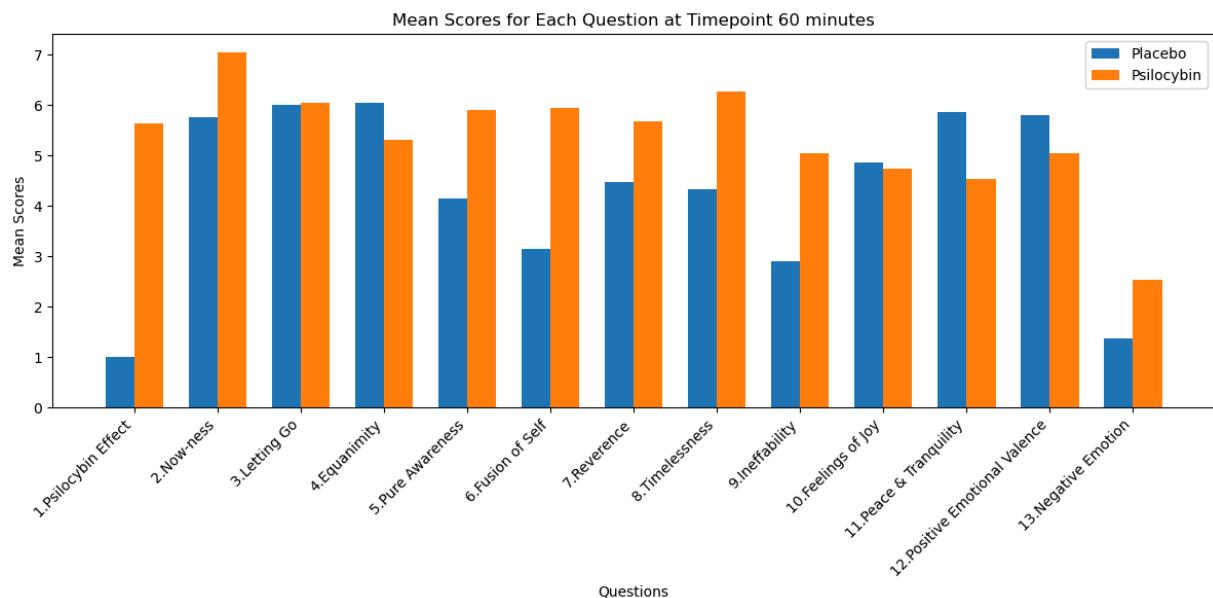
```

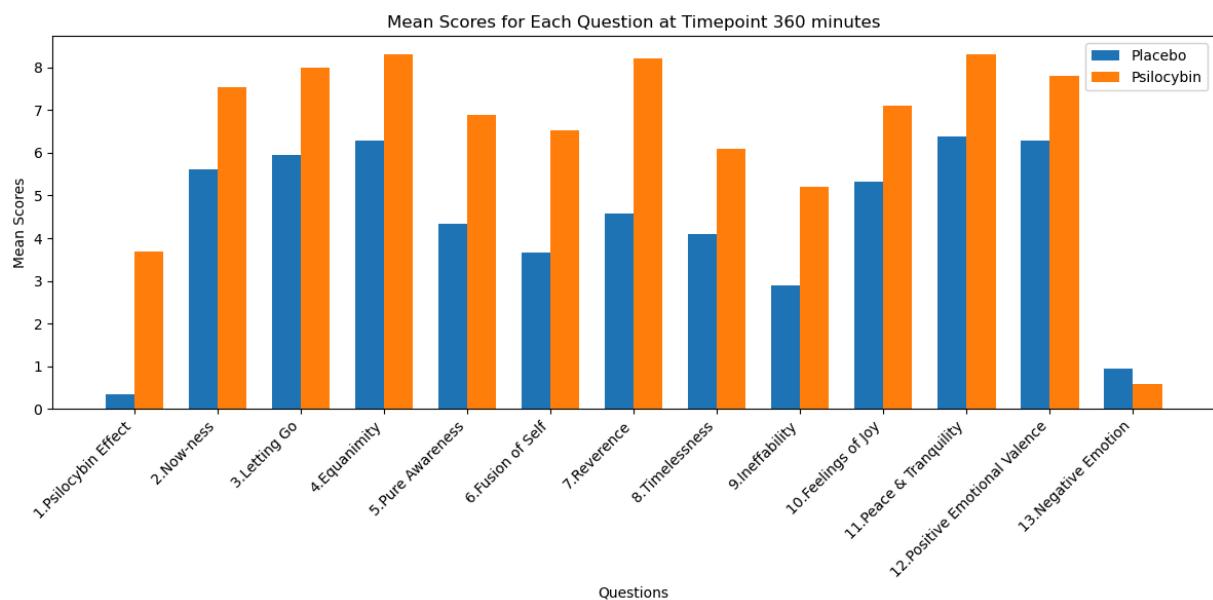
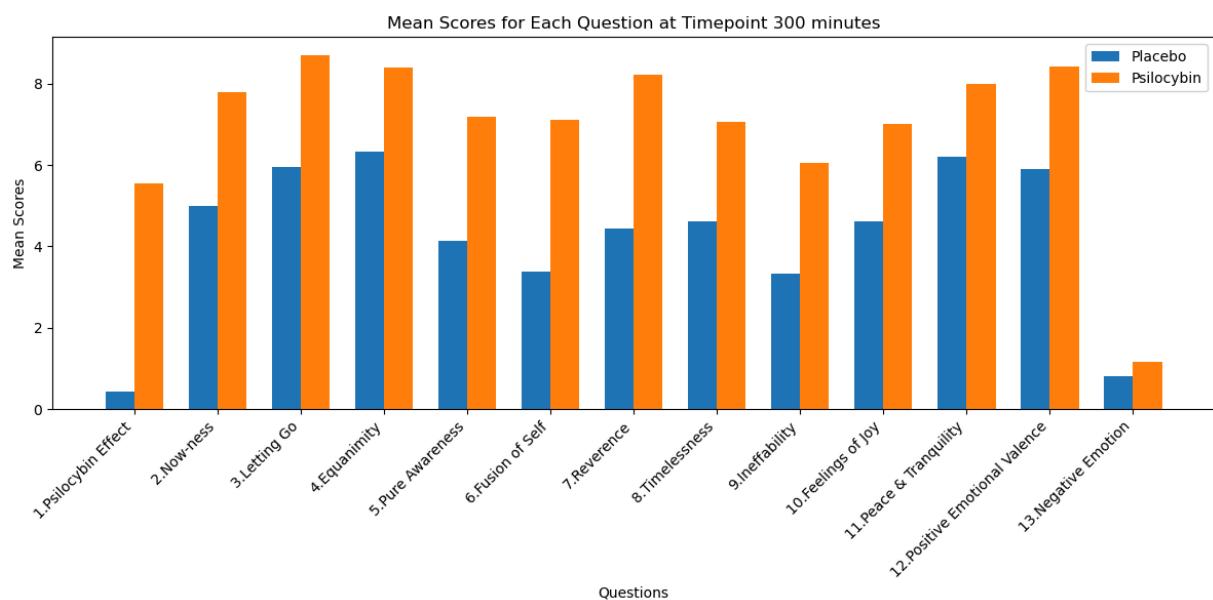
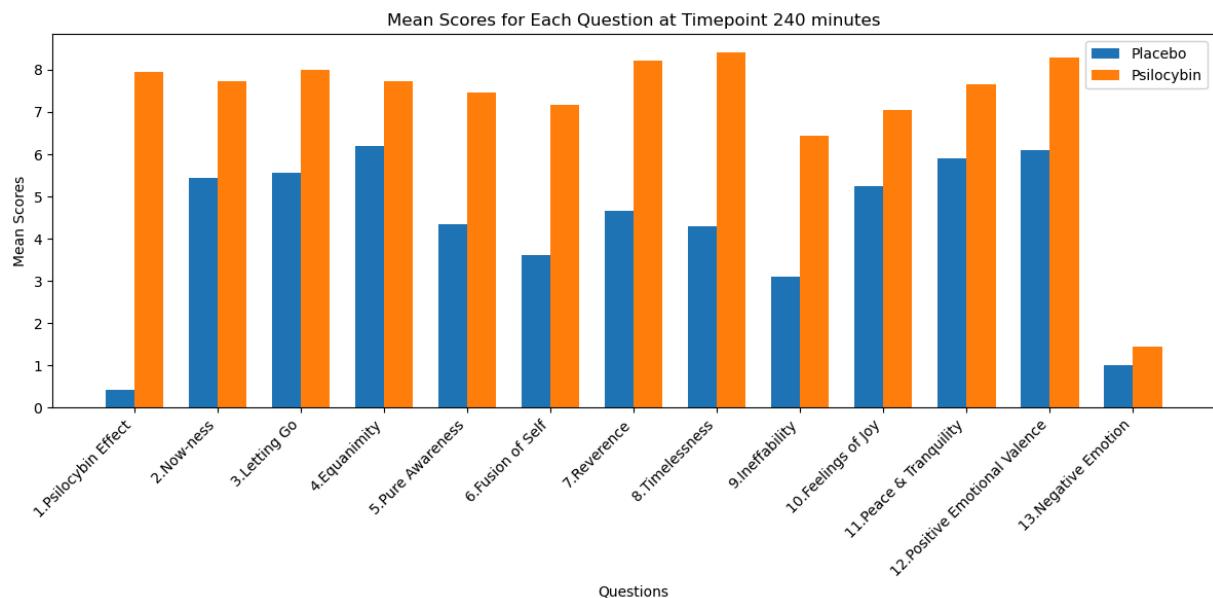
ax.set_xticks(x)
ax.set_xticklabels(shortened_rating_columns, rotation=45, ha='right')
ax.legend()

fig.tight_layout()
plt.show()

```







```
In [36]: df[rating_columns] = df[rating_columns].apply(pd.to_numeric, errors='coerce')

In [39]: session_1 = df[df['Session (1, 2)'] == 1]
session_2 = df[df['Session (1, 2)'] == 2]
crossover_participants = session_1[(session_1['Condition (PLA: placebo, EXP: 25 mg/
```

```
In [41]: results_paired = {}
for col in rating_columns:
    placebo_scores = session_1[session_1['Volunteer number'].isin(crossover_participants['Volunteer number'])][col]
    psilocybin_scores = session_2[session_2['Volunteer number'].isin(crossover_participants['Volunteer number'])][col]
    # Perform paired t-test
    t_stat, p_value = stats.ttest_rel(placebo_scores, psilocybin_scores, nan_policy='omit')
    results_paired[col] = (t_stat, p_value)

for col, (t_stat, p_value) in results_paired.items():
    print(f"{col}: T-statistic = {t_stat}, P-value = {p_value}")

-----
```

ValueError Traceback (most recent call last)

```
Cell In[41], line 6
      4     psilocybin_scores = session_2[session_2['Volunteer number'].isin(crossover_participants['Volunteer number'])][col]
      5         # Perform paired t-test
--> 6     t_stat, p_value = stats.ttest_rel(placebo_scores, psilocybin_scores, nan_policy='omit')
      7     results_paired[col] = (t_stat, p_value)
      8 for col, (t_stat, p_value) in results_paired.items():

File ~/anaconda3/lib/python3.11/site-packages/scipy/stats/_axis_nan_policy.py:502, in _axis_nan_policy_factory.<locals>.axis_nan_policy_decorator.<locals>.axis_nan_policy_wrapper(**failed resolving arguments**)
    500 if sentinel:
    501     samples = _remove_sentinel(samples, paired, sentinel)
--> 502 res = hypotest_fun_out(*samples, **kwds)
    503 res = result_to_tuple(res)
    504 res = _add_reduced_axes(res, reduced_axes, keepdims)

File ~/anaconda3/lib/python3.11/site-packages/scipy/stats/_stats_py.py:7133, in tttest_rel(a, b, axis, nan_policy, alternative)
    7131 nb = _get_len(b, axis, "second argument")
    7132 if na != nb:
-> 7133     raise ValueError('unequal length arrays')
    7135 if na == 0 or nb == 0:
    7136     # _axis_nan_policy decorator ensures this only happens with 1d input
    7137     return TtestResult(np.nan, np.nan, df=np.nan, alternative=np.nan,
                           standard_error=np.nan, estimate=np.nan)

ValueError: unequal length arrays
```

For the participants who received placebo in session 1 and were crossed over to psilocybin in session 2, a paired t-test was performed for each subjective rating variable. This test was performed to determine if there was a significant difference in responses before and after the crossover from placebo to psilocybin. The results indicated significant differences.

between conditions for most variables, such as "Overall Psilocybin Effect", "Now-ness", "Letting Go", and others, with extremely low p-values, implying strong statistical significance.

```
In [43]: psilocybin_only = session_1[session_1['Condition (PLA: placebo, EXP: 25 mg/70 kg psilocybin)'] == 'placebo only']
placebo_only = session_1[session_1['Condition (PLA: placebo, EXP: 25 mg/70 kg psilocybin)'] == 'placebo only']

#for col in rating_columns:
#    print(f"{col}: {placebo_only[col].isna().sum()} missing values in placebo group")
#    print(f"{col}: {psilocybin_only[col].isna().sum()} missing values in psilocybin group")

placebo_only_cleaned = placebo_only.dropna(subset=rating_columns)
psilocybin_only_cleaned = psilocybin_only.dropna(subset=rating_columns)

#print(placebo_only.shape)
#print(placebo_only_cleaned.shape)
```

```
In [45]: results_independent = {}
for col in rating_columns:
    placebo_scores = placebo_only[col]
    psilocybin_scores = psilocybin_only[col]

    # Perform the two-sample t-test
    t_stat, p_value = stats.ttest_ind(placebo_scores, psilocybin_scores, nan_policy='pairwise')
    results_independent[col] = (t_stat, p_value)

for col, (t_stat, p_value) in results_independent.items():
    print(f"{col}: T-statistic = {t_stat}, P-value = {p_value}")
```

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -15.429444401377932, P-value = 1.829968648
 $04383e-41$

2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -5.807565754223764, P-value = 1.4086530819
 $80698e-08$

3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -3.4222356395405535, P-value = 0.000693751
 208854987

4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -1.0788089163713, P-value = 0.281407435099
 00423

5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -7.920759406904275, P-value = 3.1062213986
 $7374e-14$

6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -8.695702299863871, P-value = 1.3220305417
 $83588e-16$

7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -8.321093126288845, P-value = 1.9135481802
 $495092e-15$

8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -8.060714853347394, P-value = 1.1795072006
 $004211e-14$

9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -7.908199881368684, P-value = 3.3842408781
 $00939e-14$

10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -4.6455268571770985, P-value = 4.790566385
 $977174e-06$

11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -1.6738433562308155, P-value = 0.095049691
 3112998

12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -2.4437250220681954, P-value = 0.015026933
 942036944

13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -2.5920627906530083, P-value = 0.009937648
 347856558

```
In [47]: for col in rating_columns:
    placebo_scores = placebo_only_cleaned[col]
    psilocybin_scores = psilocybin_only_cleaned[col]
    t_stat, p_value = stats.ttest_ind(placebo_scores, psilocybin_scores, nan_policy='pairwise')
    results_independent[col] = (t_stat, p_value)

for col, (t_stat, p_value) in results_independent.items():
    print(f'{col}: T-statistic = {t_stat}, P-value = {p_value}')
```

1. Overall Psilocybin Effect ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -15.121591921917284, P-value = 3.919616204
202543e-40

2. Now-ness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -5.7045505543911155, P-value = 2.480418165
038184e-08

3. Letting Go ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -3.2329655931459844, P-value = 0.001341274
6126078713

4. Equanimity ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -0.9192942150934472, P-value = 0.358573016
22430715

5. Pure being and pure awareness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -7.7813754952725285, P-value = 8.100984271
662408e-14

6. Fusion of your personal self into a larger whole ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -8.56778916092202, P-value = 3.38738317066
0452e-16

7. Sense of reverence or sacredness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -8.094743032561867, P-value = 9.5203136536
51218e-15

8. Timelessness ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -7.865891329449438, P-value = 4.5725851794
23882e-14

9. Ineffability ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -8.026053821879076, P-value = 1.5295534870
23367e-14

10. Feelings of joy ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -4.899774759162811, P-value = 1.4679740926
42273e-06

11. Feelings of peace and tranquility ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -1.6597118800429018, P-value = 0.097865550
58434498

12. Positive Emotional Valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -2.3868296782583407, P-value = 0.017523356
844877214

13. Negative emotional valence ($0 = \text{none to}$
 $10 = \text{strongest imaginable})$: T-statistic = -2.440220296377513, P-value = 0.0151724200
3345195

an independent t-test for participants who received either psilocybin or placebo in session 1, comparing these two groups. This test was first conducted with missing data and later with cleaned data (remove NaN). For the cleaned data, you found significant differences between the psilocybin and placebo groups across several variables, including "Overall Psilocybin Effect", "Letting Go", "Sense of reverence or sacredness", and others, with p-values showing strong statistical significance (e.g., p-values < 0.001)

Both the paired and independent t-tests indicated that psilocybin had a statistically significant effect on participants' subjective experiences when compared to placebo.

Trying Lazy Predict

```
In [95]: !pip install opendatasets --upgrade --quiet
!pip3 install lazypredict
!pip3 install graphviz
```

```
Requirement already satisfied: lazypredict in /Users/harriethe/anaconda3/lib/python3.11/site-packages (0.2.12)
Requirement already satisfied: click in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lazypredict) (8.0.4)
Requirement already satisfied: scikit-learn in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lazypredict) (1.5.2)
Requirement already satisfied: pandas in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lazypredict) (1.5.3)
Requirement already satisfied: tqdm in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lazypredict) (4.65.0)
Requirement already satisfied: joblib in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lazypredict) (1.2.0)
Requirement already satisfied: lightgbm in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lazypredict) (4.5.0)
Requirement already satisfied: xgboost in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lazypredict) (2.1.1)
Requirement already satisfied: numpy>=1.17.0 in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lightgbm->lazypredict) (1.24.3)
Requirement already satisfied: scipy in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from lightgbm->lazypredict) (1.10.1)
Requirement already satisfied: python-dateutil>=2.8.1 in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from pandas->lazypredict) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from pandas->lazypredict) (2022.7)
Requirement already satisfied: threadpoolctl>=3.1.0 in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from scikit-learn->lazypredict) (3.5.0)
Requirement already satisfied: six>=1.5 in /Users/harriethe/anaconda3/lib/python3.11/site-packages (from python-dateutil>=2.8.1->pandas->lazypredict) (1.16.0)
Requirement already satisfied: graphviz in /Users/harriethe/anaconda3/lib/python3.11/site-packages (0.20.3)
```

```
In [103...]:
import os
import numpy as np
import pandas as pd
import opendatasets as od
import lazypredict
from lazypredict.Supervised import LazyClassifier
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier # for Random Forest Classifier
from sklearn.metrics import accuracy_score, confusion_matrix, precision_score, recall_score
from sklearn.tree import export_graphviz
from IPython.display import Image
import graphviz
```

```
In [112...]:
X = df[rating_columns]
y = df['Condition (PLA: placebo, EXP: 25 mg/70 kg psilocybi)']
```

```
In [114...]:
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
y = le.fit_transform(y)
```

```
# Split the data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Initialize LazyClassifier
clf = LazyClassifier(verbose=0, ignore_warnings=True, custom_metric=None)

# Fit and predict
models, predictions = clf.fit(X_train, X_test, y_train, y_test)

# View results
print(models)
```

100%|██████████| 31/31 [00:03<00:00, 10.29it/s]

Model	Accuracy	Balanced Accuracy	ROC AUC	F1 Score	\
LGBMClassifier	0.50	0.52	None	0.49	
NuSVC	0.49	0.52	None	0.46	
LogisticRegression	0.49	0.52	None	0.46	
CalibratedClassifierCV	0.48	0.51	None	0.42	
LabelSpreading	0.50	0.50	None	0.49	
RidgeClassifier	0.47	0.50	None	0.40	
RandomForestClassifier	0.48	0.50	None	0.46	
LinearSVC	0.47	0.50	None	0.41	
SVC	0.47	0.50	None	0.41	
RidgeClassifierCV	0.46	0.50	None	0.38	
LabelPropagation	0.49	0.50	None	0.48	
KNeighborsClassifier	0.47	0.49	None	0.44	
ExtraTreesClassifier	0.48	0.49	None	0.46	
LinearDiscriminantAnalysis	0.46	0.49	None	0.41	
XGBClassifier	0.48	0.49	None	0.47	
BaggingClassifier	0.45	0.47	None	0.43	
AdaBoostClassifier	0.47	0.47	None	0.46	
PassiveAggressiveClassifier	0.45	0.45	None	0.45	
QuadraticDiscriminantAnalysis	0.45	0.45	None	0.42	
SGDClassifier	0.43	0.44	None	0.40	
ExtraTreeClassifier	0.42	0.43	None	0.40	
Perceptron	0.43	0.42	None	0.43	
GaussianNB	0.42	0.42	None	0.40	
DecisionTreeClassifier	0.40	0.41	None	0.40	

NearestCentroid	0.40	0.40	None	0.37
BernoulliNB	0.37	0.37	None	0.35
DummyClassifier	0.29	0.33	None	0.13
<hr/>				
Model		Time Taken		
LGBMClassifier	0.18			
NuSVC	0.06			
LogisticRegression	0.03			
CalibratedClassifierCV	0.11			
LabelSpreading	0.04			
RidgeClassifier	0.02			
RandomForestClassifier	0.25			
LinearSVC	0.02			
SVC	0.04			
RidgeClassifierCV	0.02			
LabelPropagation	0.04			
KNeighborsClassifier	0.03			
ExtraTreesClassifier	0.22			
LinearDiscriminantAnalysis	0.04			
XGBClassifier	1.36			
BaggingClassifier	0.06			
AdaBoostClassifier	0.25			
PassiveAggressiveClassifier	0.03			
QuadraticDiscriminantAnalysis	0.02			
SGDClassifier	0.02			
ExtraTreeClassifier	0.02			
Perceptron	0.02			
GaussianNB	0.02			
DecisionTreeClassifier	0.02			
NearestCentroid	0.02			
BernoulliNB	0.02			
DummyClassifier	0.02			

Some Random PCA I done

In [116...]

```
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt
```

In [146...]

```
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(strategy='mean')
X_imputed = imputer.fit_transform(df[rating_columns])
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X_imputed)
```

In [172...]

```
pca = PCA(n_components=X_scaled.shape[1])
X_pca = pca.fit_transform(X_scaled)
explained_variance = pca.explained_variance_ratio_
print("Explained Variance Ratio:", explained_variance)
print("Total Variance Explained by 2 components:", sum(explained_variance))
```

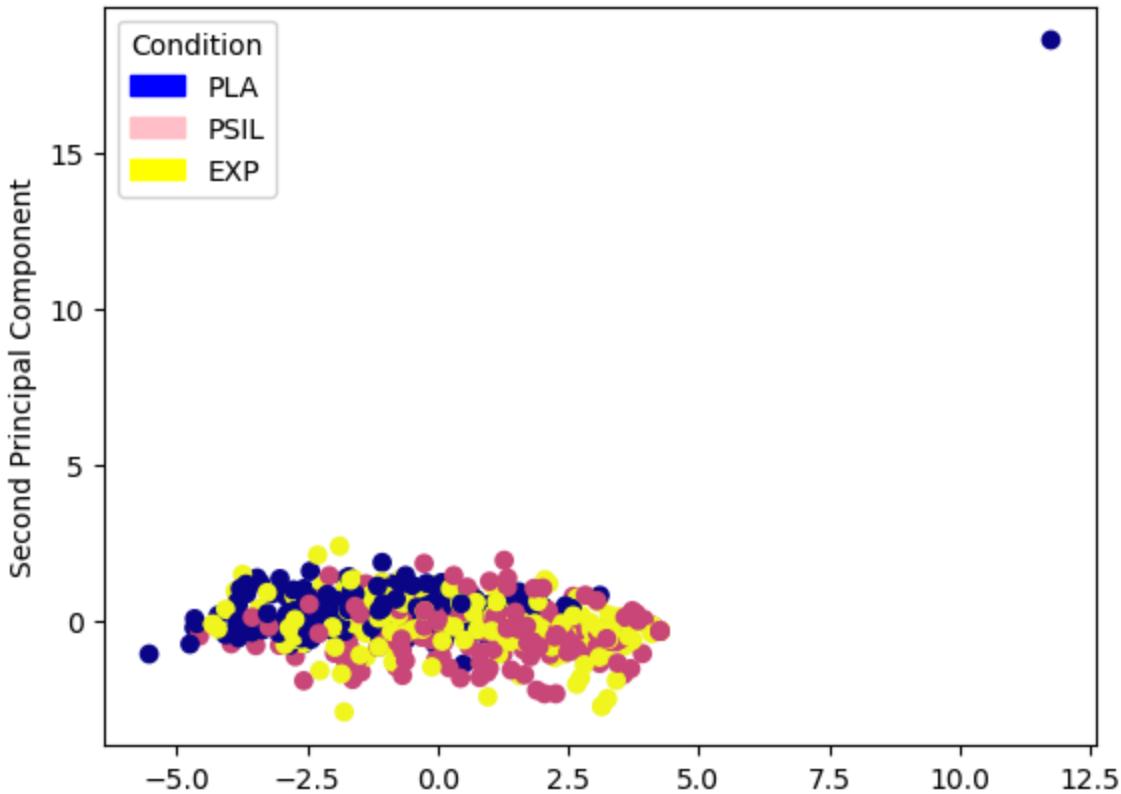
```
Explained Variance Ratio: [0.62776203 0.14278614 0.0789812 0.04592319 0.03807703 0.
02993752
0.01986962 0.01666328]
Total Variance Explained by 2 components: 0.9999999999999999
```

In [206...]

```
import matplotlib.patches as mpatches
df['Condition_encoded'] = df['Condition (PLA: placebo, EXP: 25 mg/70 kg psilocybi)']

# Use the encoded values for the 'c' argument
plt.scatter(X_pca[:, 0], X_pca[:, 1], c=df['Condition_encoded'], cmap='plasma')
plt.ylabel('Second Principal Component')
plt.title('PCA of Subjective Ratings')
legend_handles = [mpatches.Patch(color='blue', label='PLA'),
                  mpatches.Patch(color='pink', label='PSIL'),
                  mpatches.Patch(color='yellow', label='EXP')]
plt.legend(handles=legend_handles, title='Condition')
plt.show()
```

PCA of Subjective Ratings



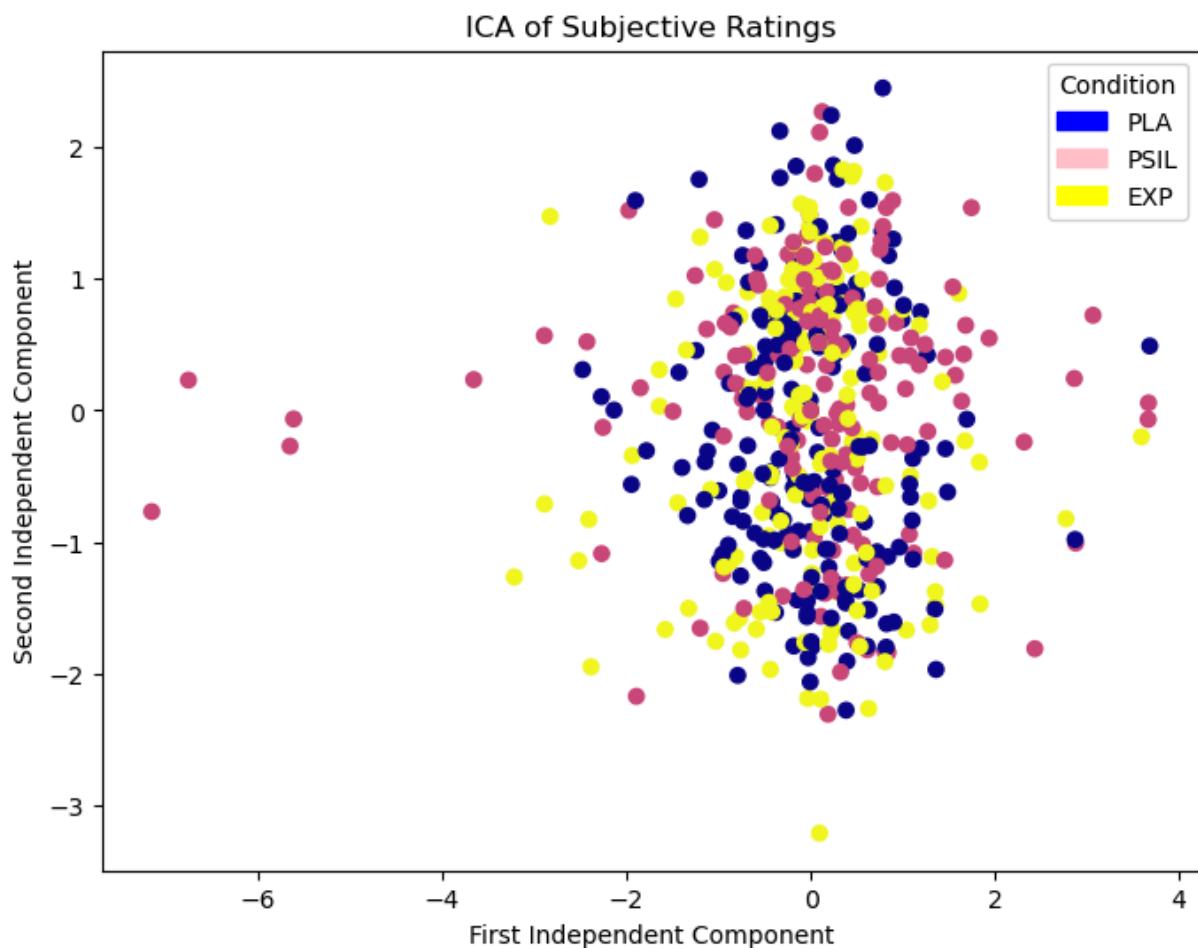
In [208...]

```
from sklearn.decomposition import FastICA
ica = FastICA(n_components=X_scaled.shape[1], random_state=42)
X_ica = ica.fit_transform(X_scaled)
```

In [216...]

```
plt.figure(figsize=(8, 6))
plt.scatter(X_ica[:, 0], X_ica[:, 1], c=df['Condition_encoded'], cmap='plasma')
plt.xlabel('First Independent Component')
plt.ylabel('Second Independent Component')
plt.title('ICA of Subjective Ratings')
# plt.colorbar(label='Condition (PLA, PSIL, EXP)')
nd_handles = [mpatches.Patch(color='blue', label='PLA'),
```

```
mpatches.Patch(color='pink', label='PSIL'),  
mpatches.Patch(color='yellow', label='EXP')]  
plt.legend(handles=legend_handles, title='Condition')  
plt.show()
```



In []: