Surprise Study Pilot 10 Analysis

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Study description

Pilot 10: Same version of the task as pilot 9 (prediction, bigger feedback, replacing anxiety with nervous/uncomfortable) + video/audio

Goal: We used the task version from pilot 9, re-introducing the video. The task can be found here: https://app.gorilla.sc/admin/task/698788/editor

notes: 1) Gorilla does not allow recording audio and video files separately, so we have to always make sure "audio" is not ticked in the setting and we only choose the video. Video file will include the audio, otherwise, audio files will overwrite the video files. 2) The second issue is that video files are only 4s approximately despite the trials being 15s, Elena is in contact with the Gorilla support team to resolve this issue. Although it does not impact the current data, we do want to solve it for the actual experiment in case someone wants to analyse those video data in the future.

Histogram and prediction relationship

There were three people that ignored the histogram values and always chose similar values for prediction: "SUBPRF34408", "SUBPRF70880", "SUBPRF89542". I will do the analysis with and without them to see how they influenced the group correlations with anxiety and mood.
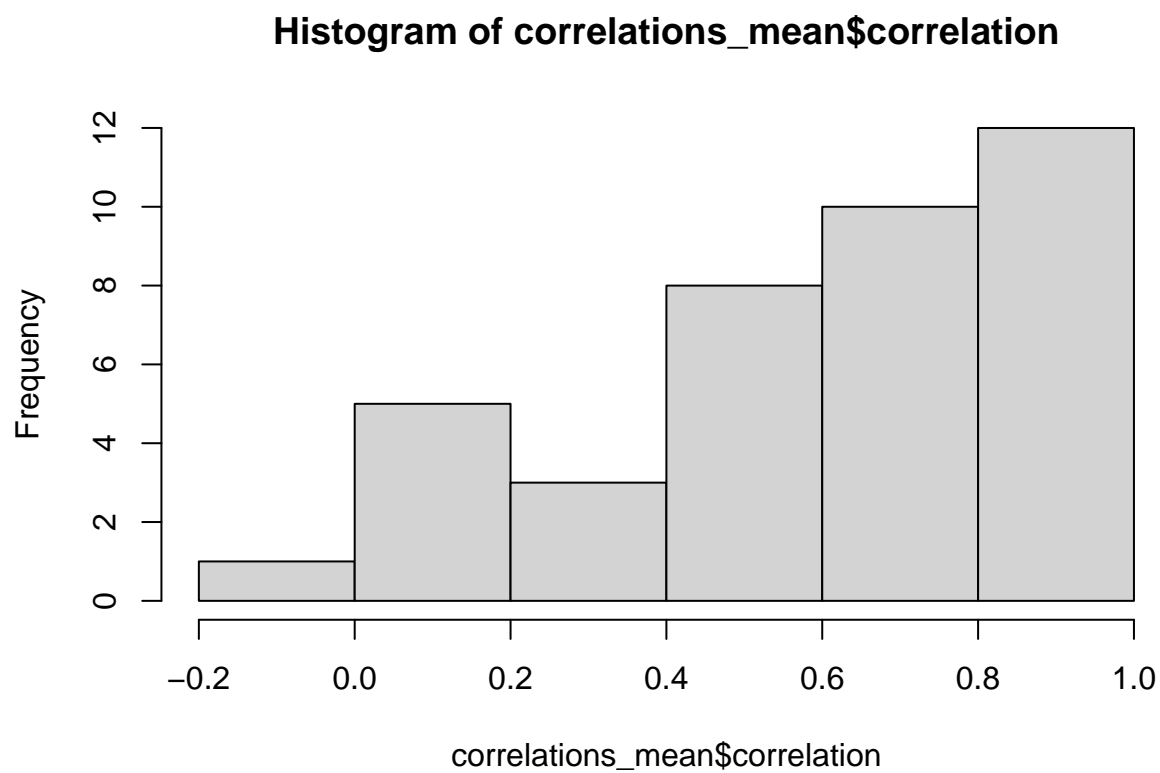
```
## [1] "average correlation between prediction and m_hist: 0.591578772599636"
```
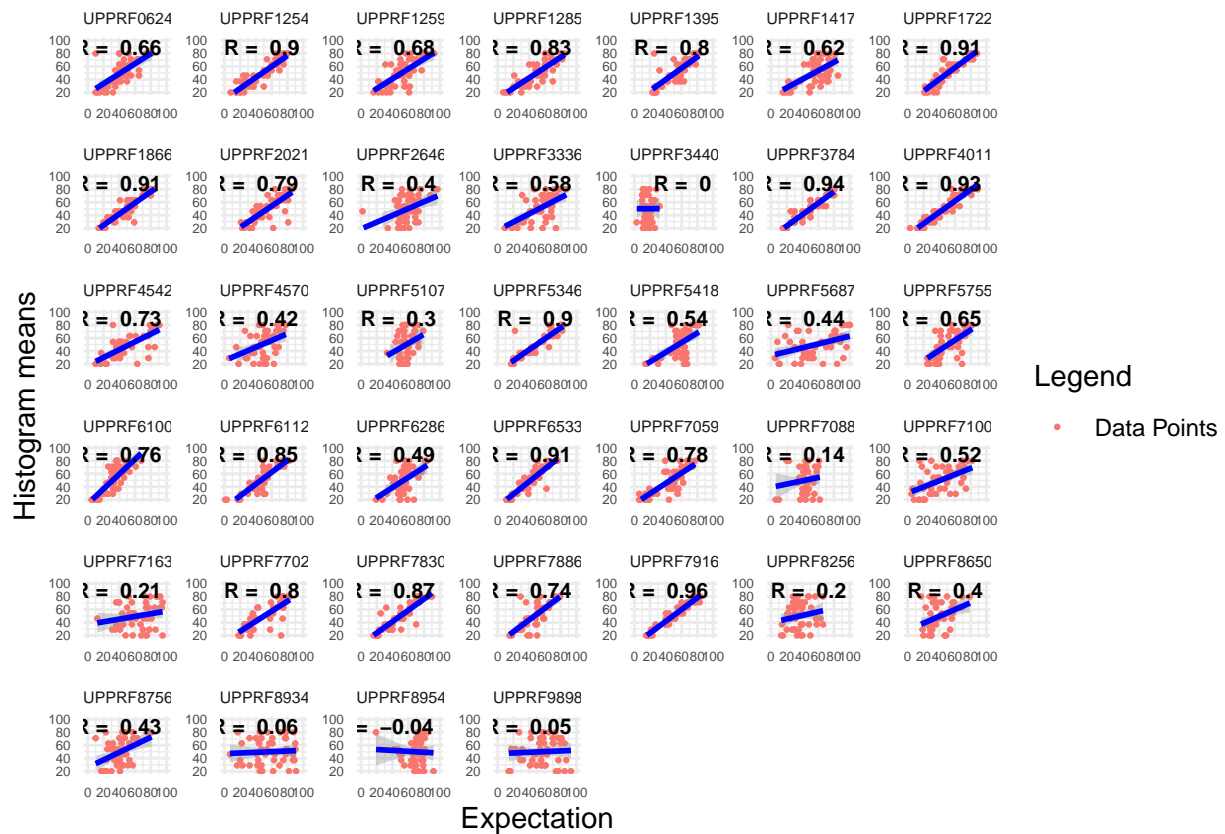
Below we can see the average correlation between hist_mean and prediction and the histogram of the individual correlations.

```
## [1] "average of correlations: 0.591578772599636"
```
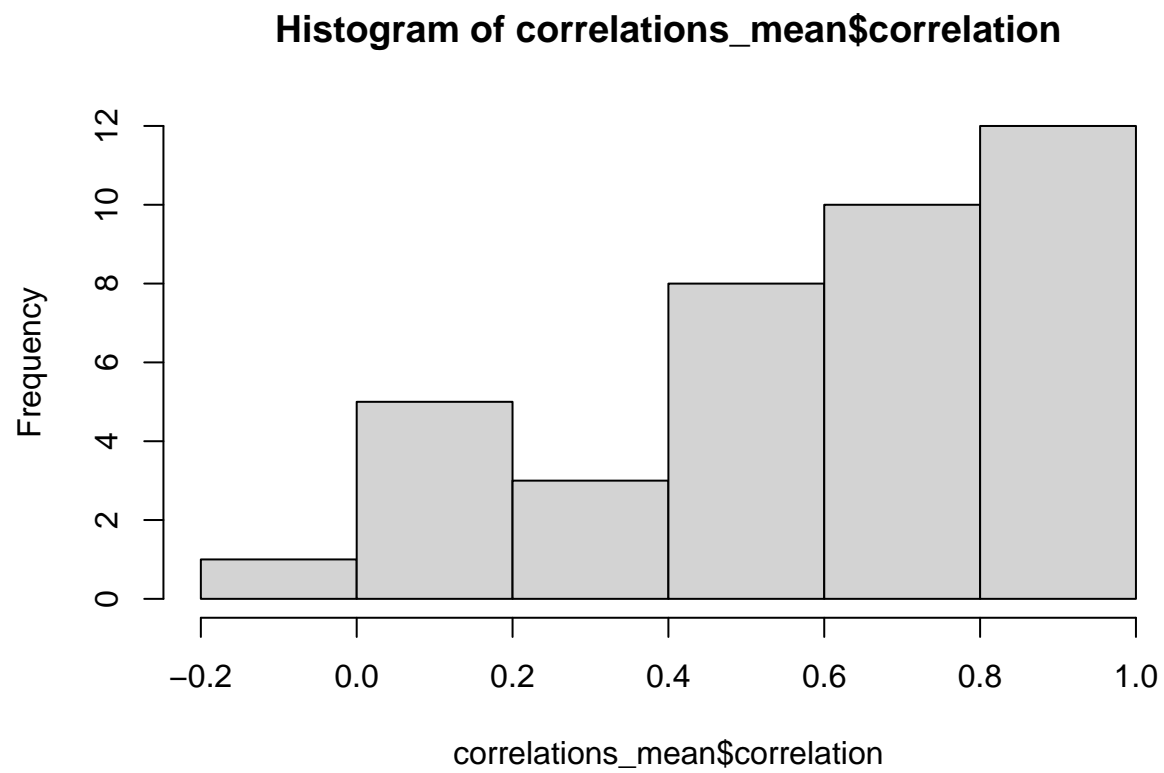
```
## [1] "sd of correlations: 0.298916065846828"
```

Histogram of correlations_mean$correlation

I will remove those 3 people who ignored the histogram and gave similar predictions across all trials and repeat the correlation:
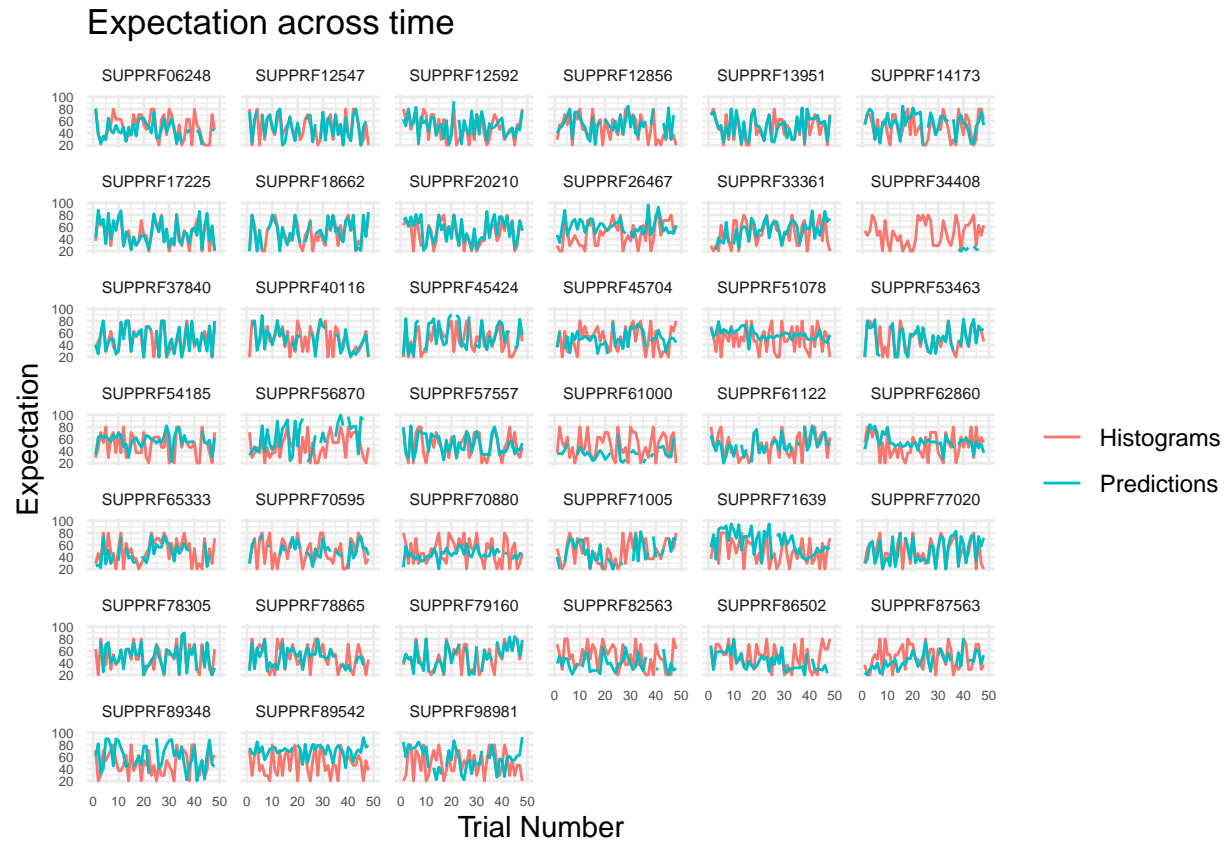
```
## [1] "average of correlations: 0.591578772599636"
```

```
## [1] "sd of correlations: 0.298916065846828"
```
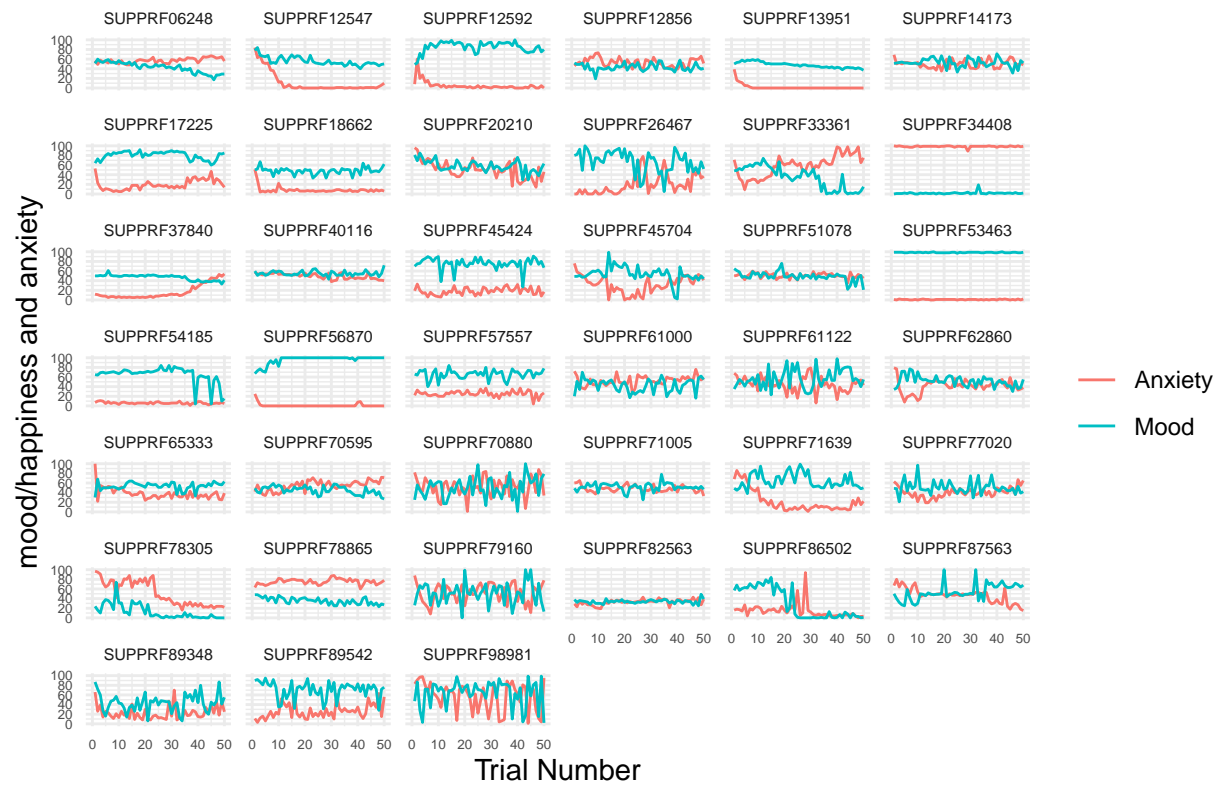
Histogram of correlations_mean$correlation

Histogram and prediction across trials

The figure below shows the histogram and expectation values over time and across trials.
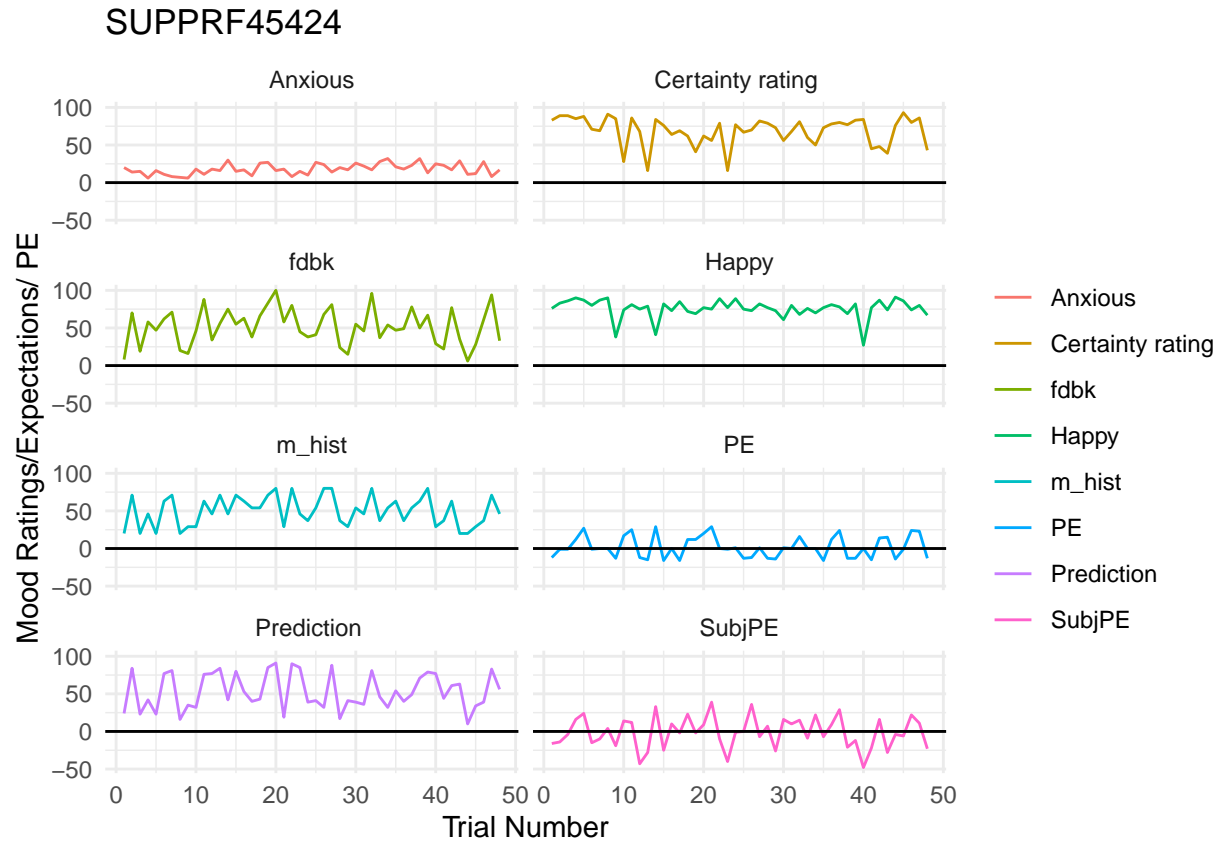

Expectation across time

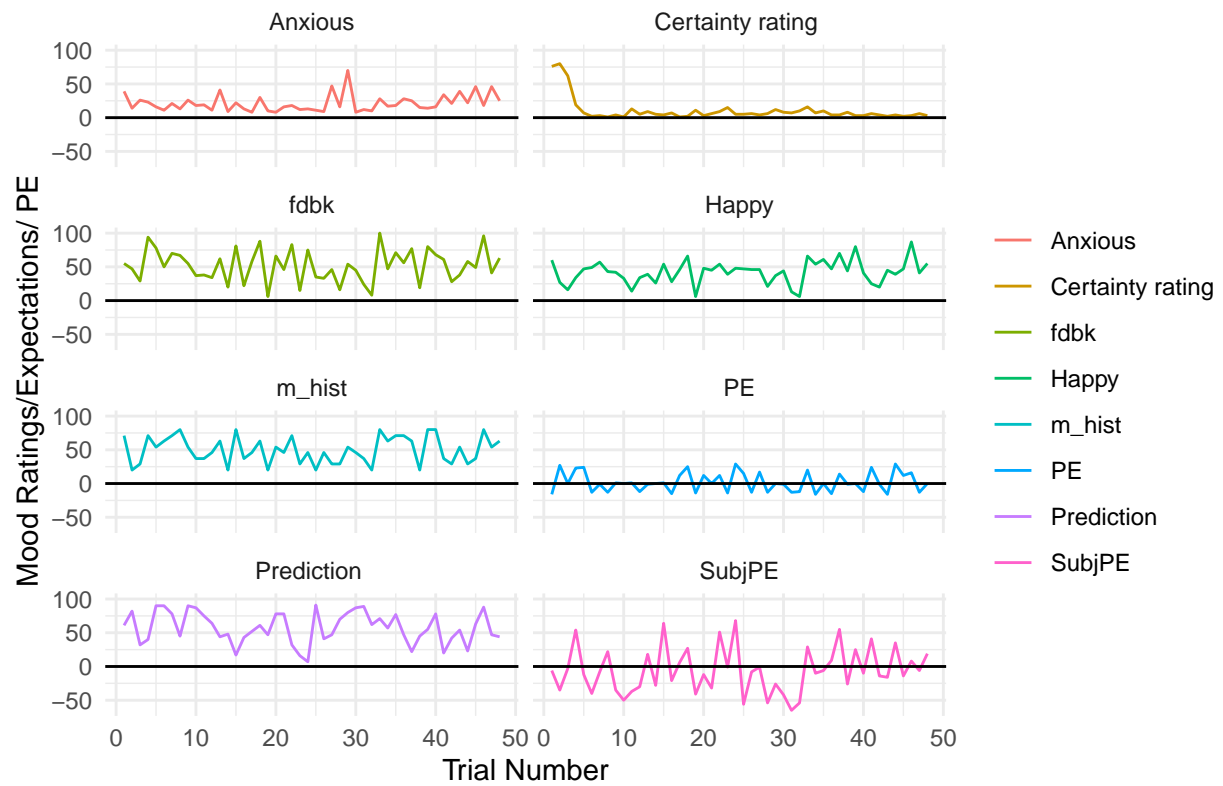# Anxiety and mood across trials

Mood and anxiety across time

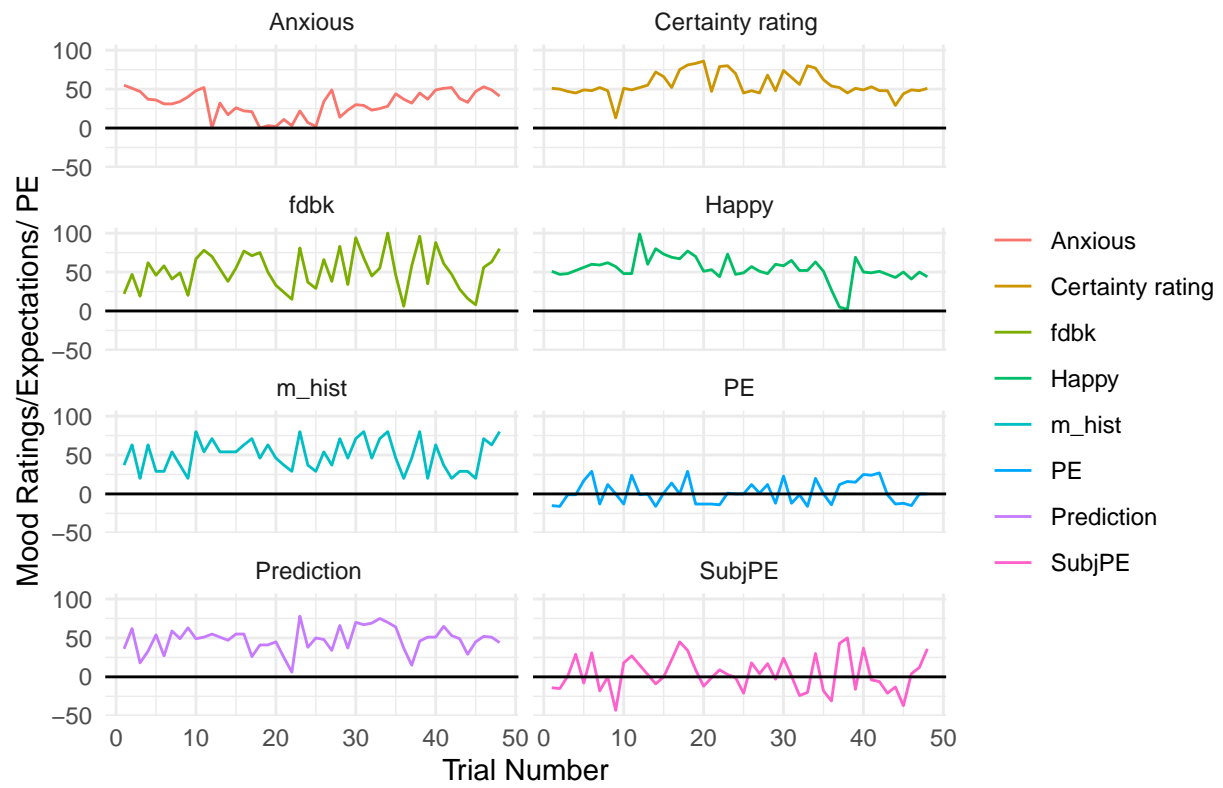# Plots for all variables per subject

Now let's make plots for each subject that show how prediction, feedback, histogram mean, anxiety, mood, confidence rating, PE (feedback - histogram), subj_PE (feedback-prediction): one plot per subject. Two subjects had a flat 0 line for anxiety.
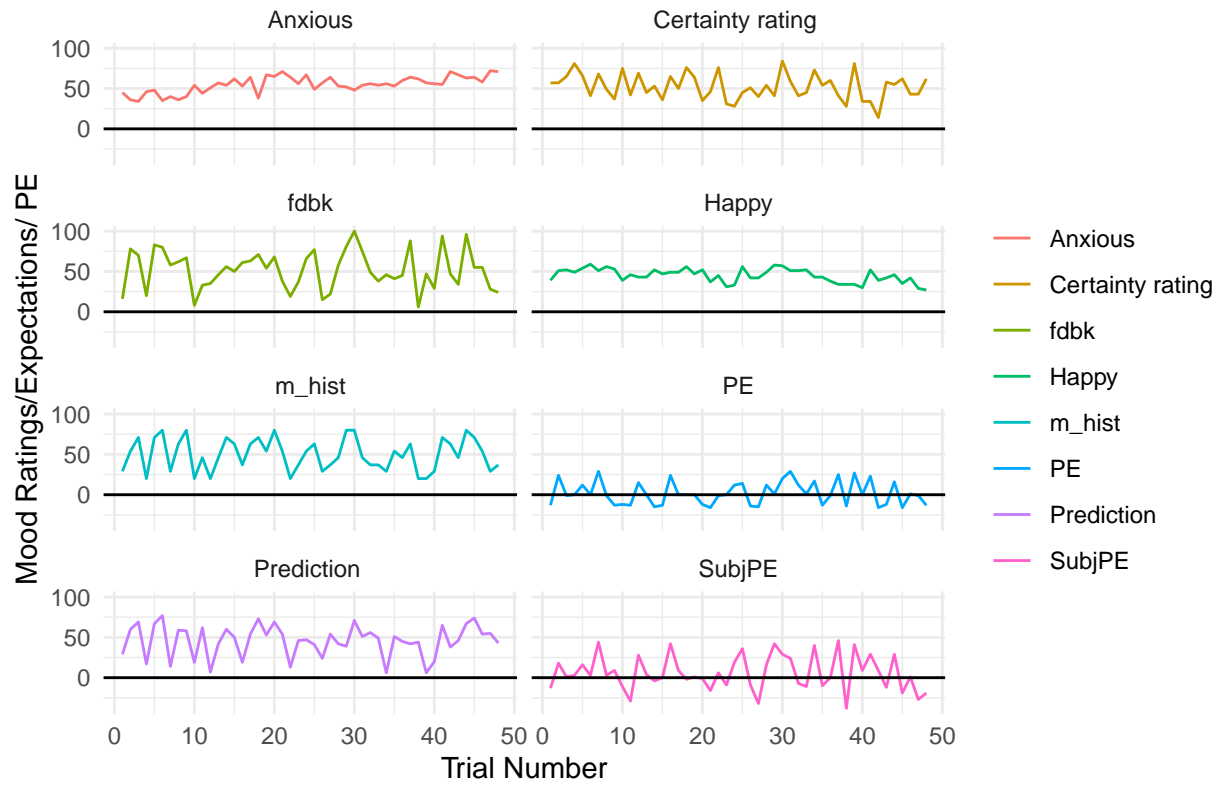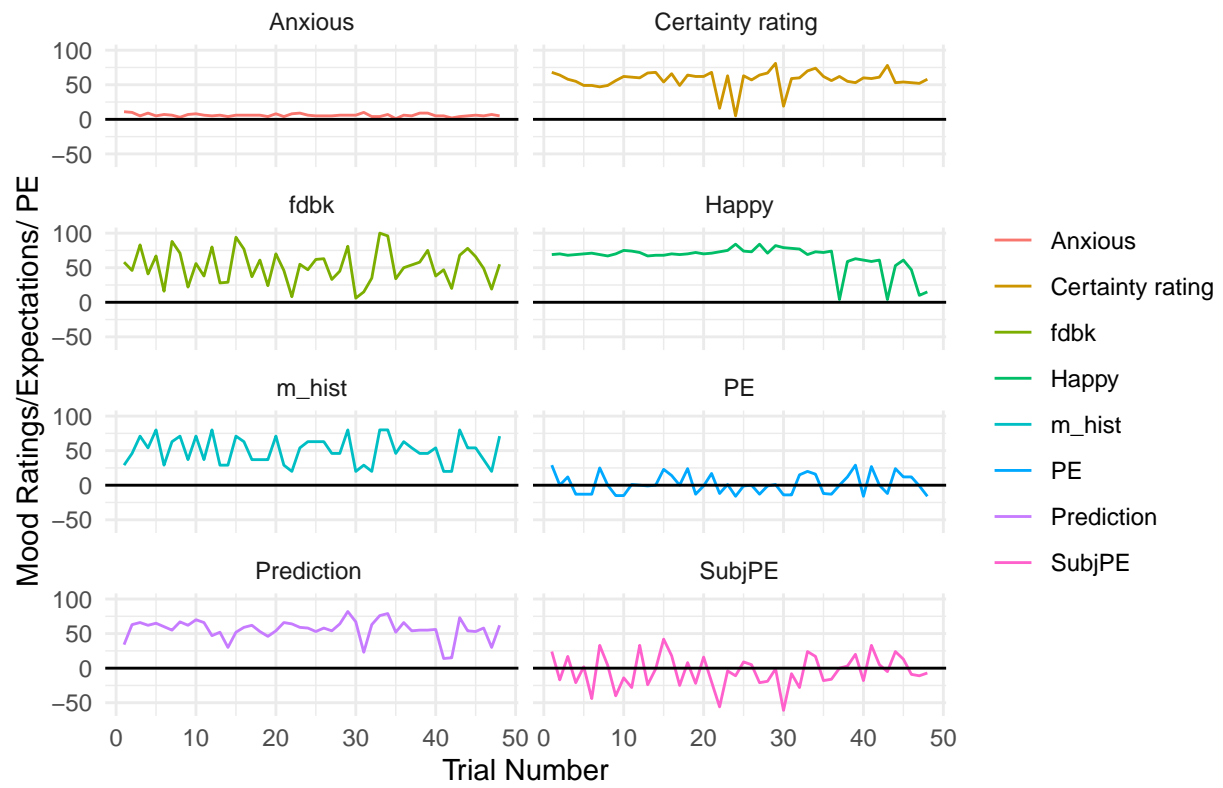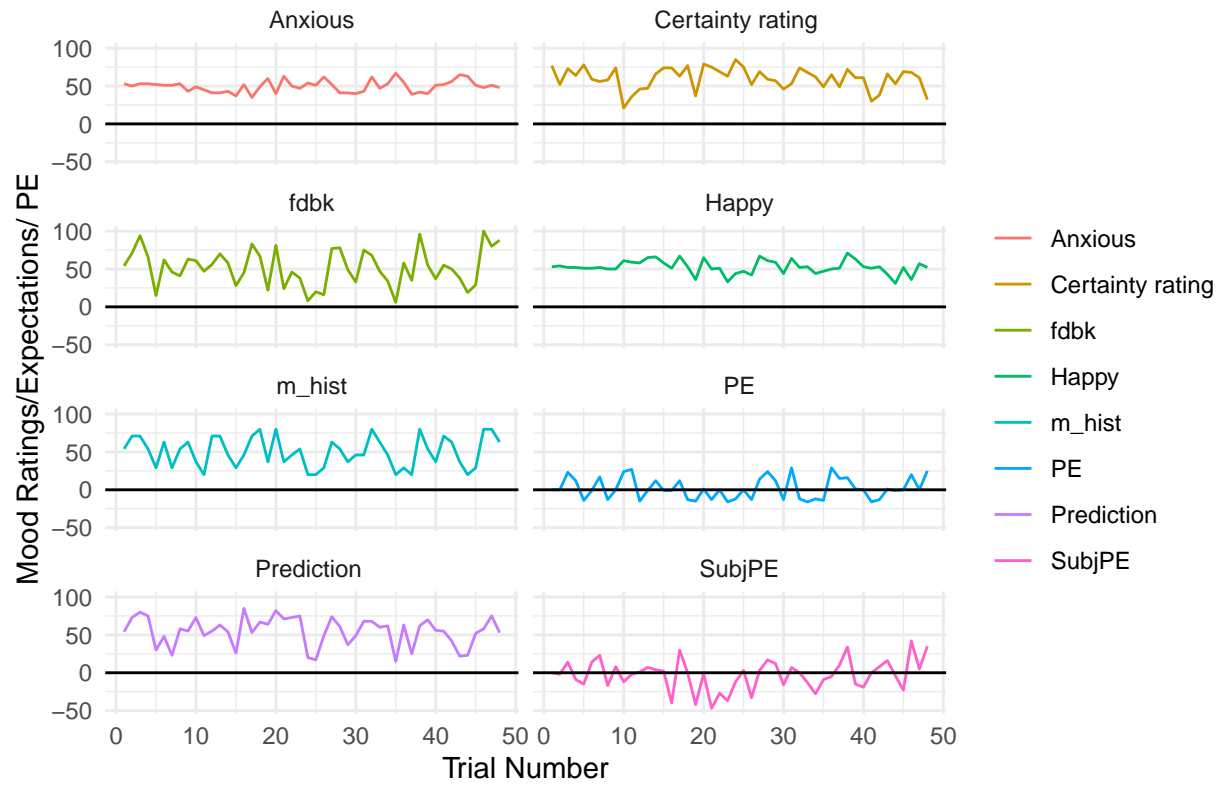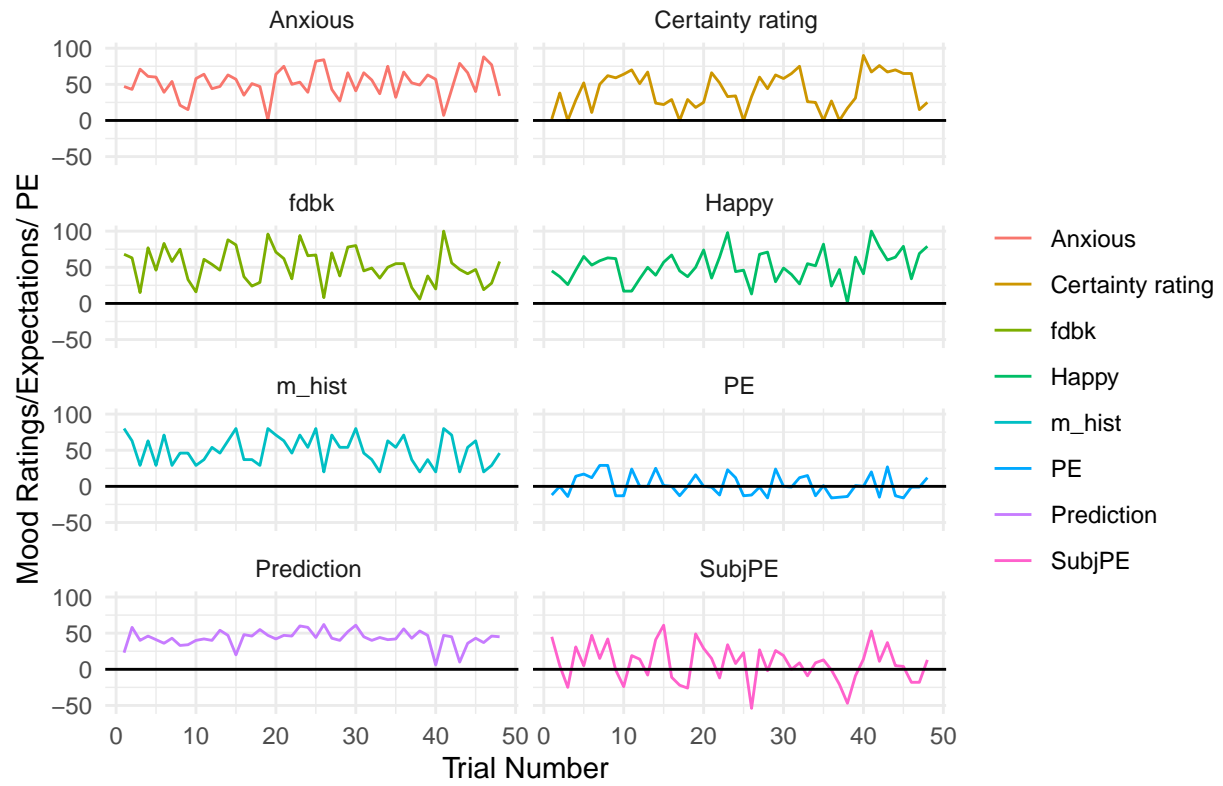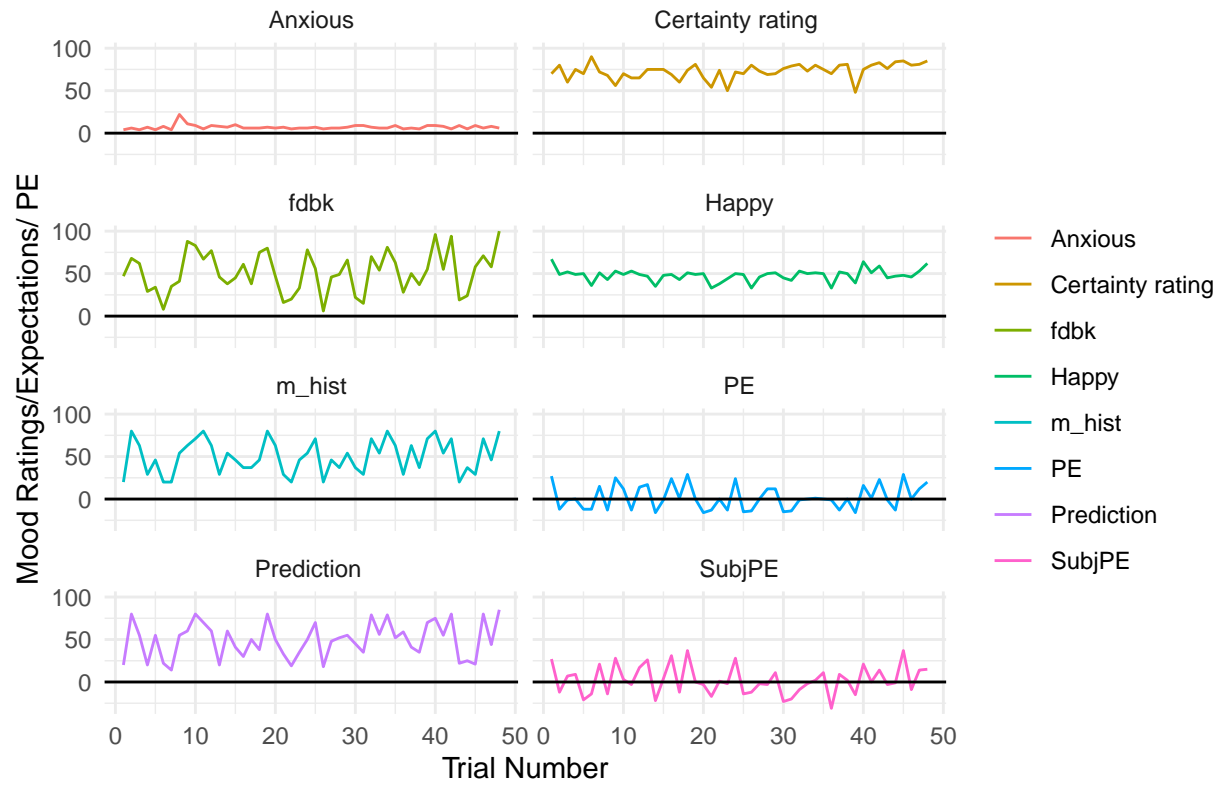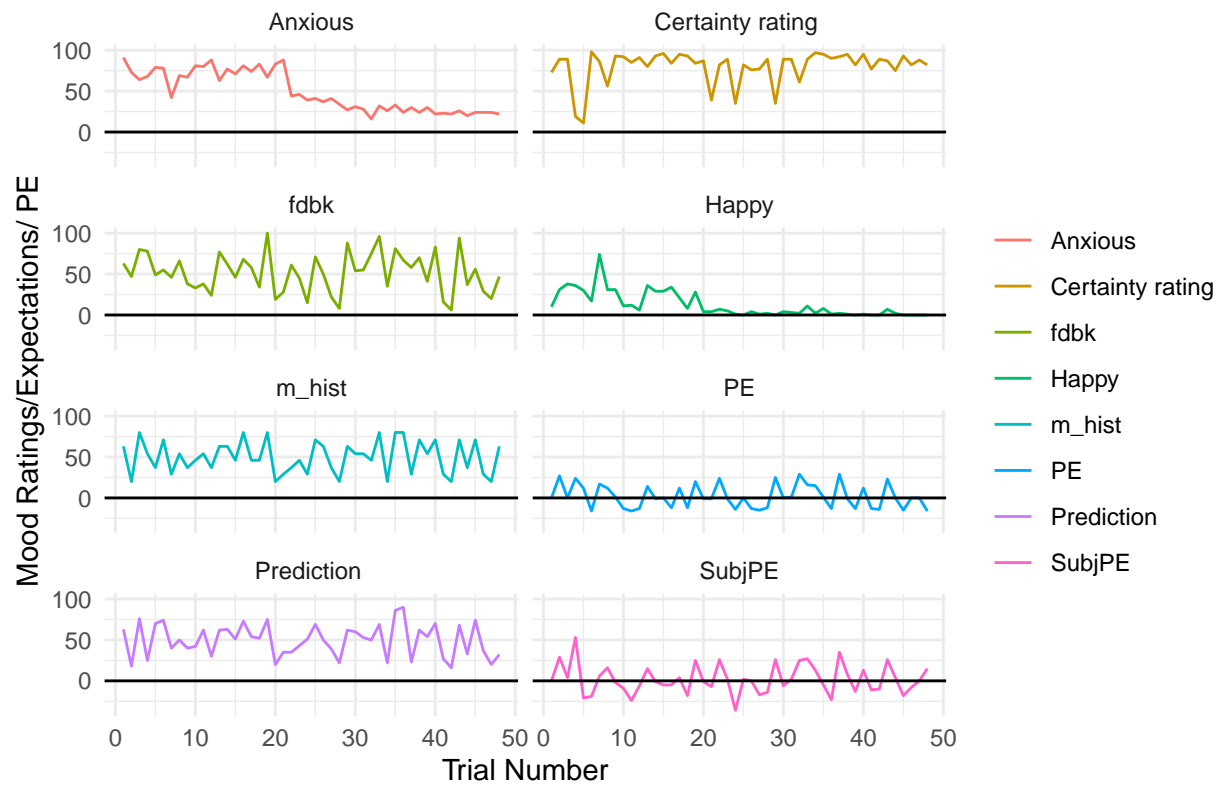
SUPPRF89348

SUPPRF45704

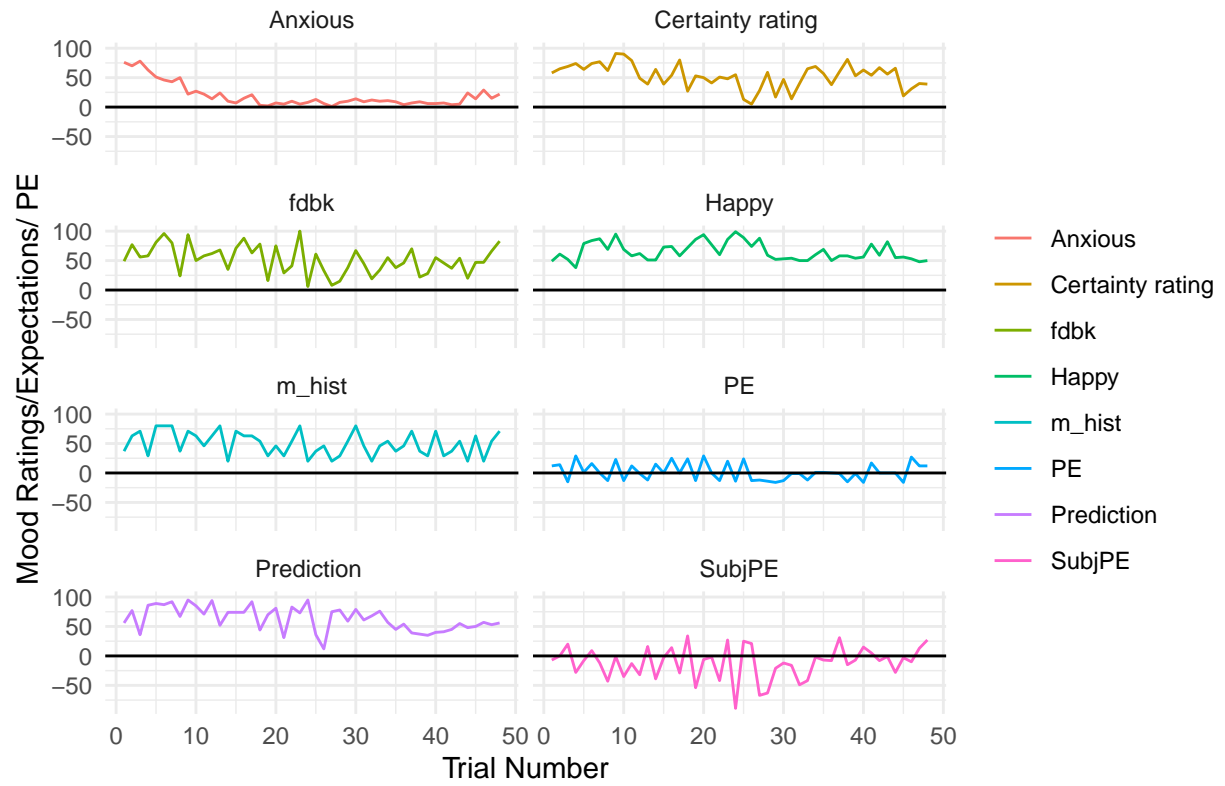# SUPPRF70595

SUPPRF54185

SUPPRF14173

SUPPRF70880

SUPPRF18662

SUPPRF78305

SUPPRF71639

SUPPRF56870
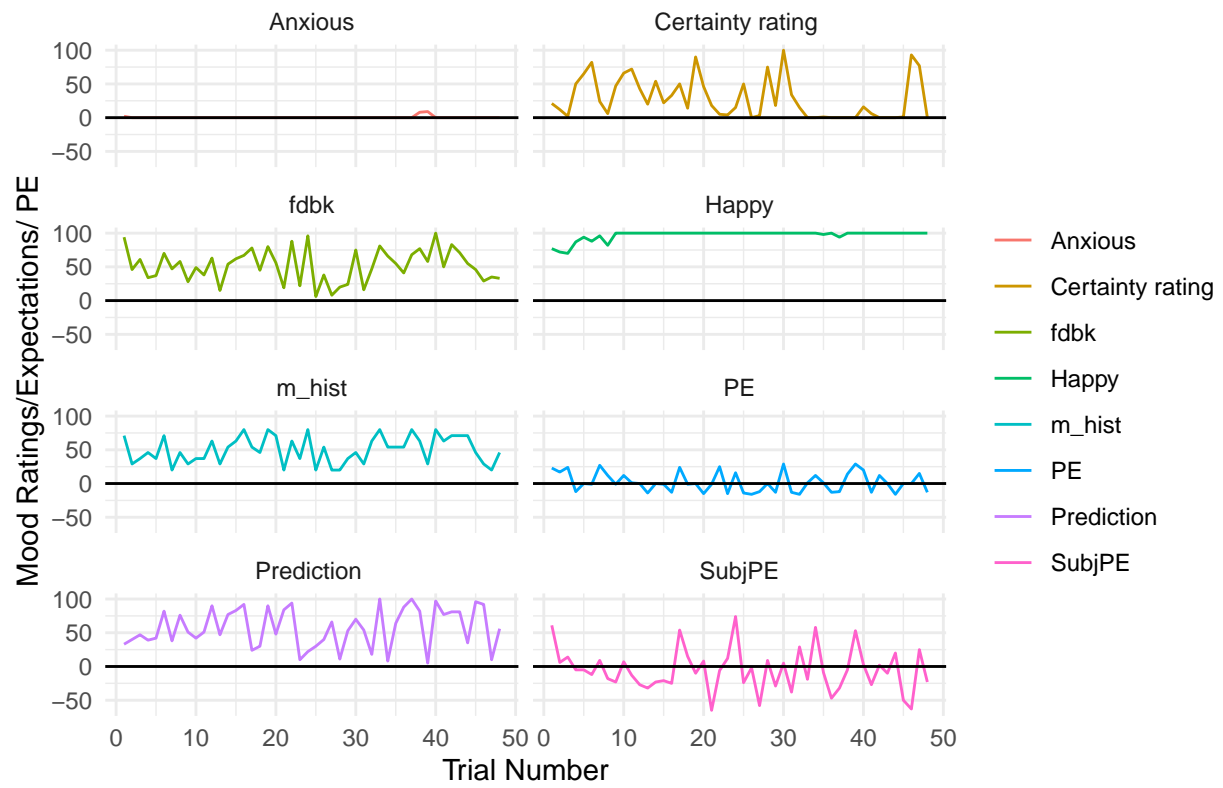
SUPPRF86502
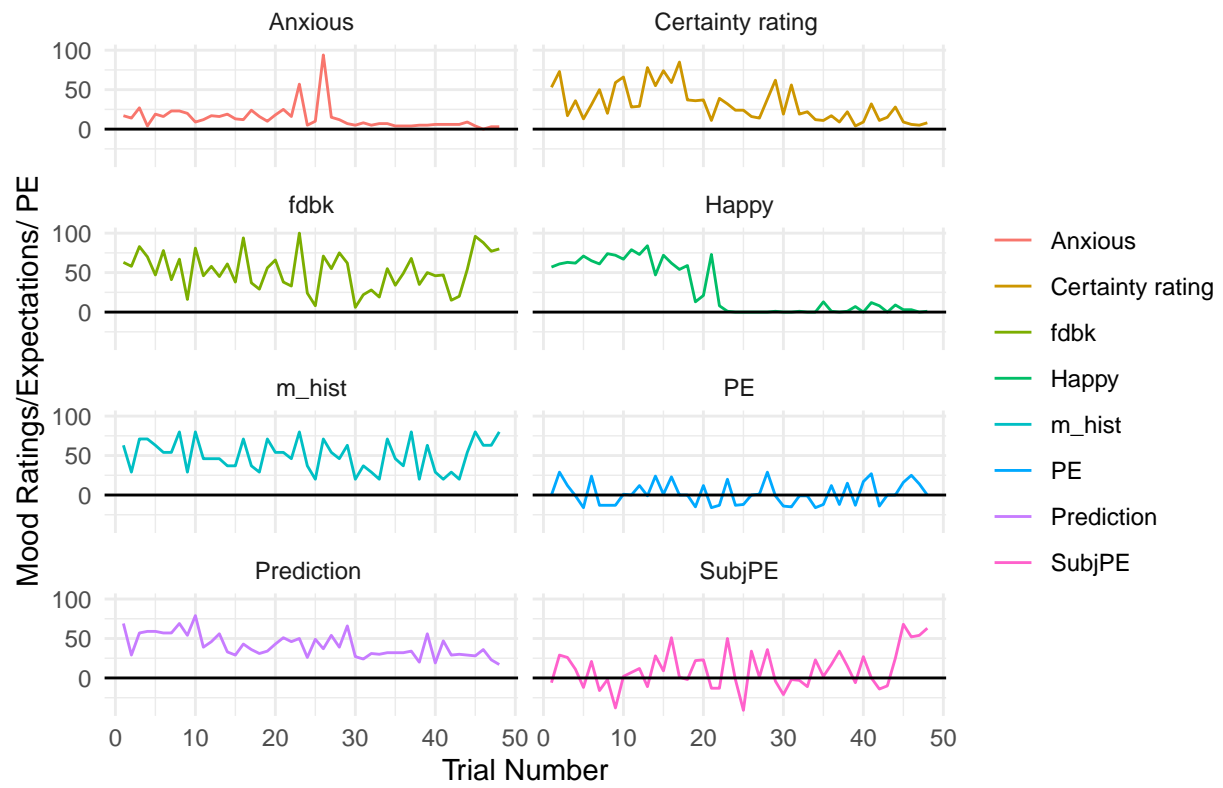
SUPPRF12592
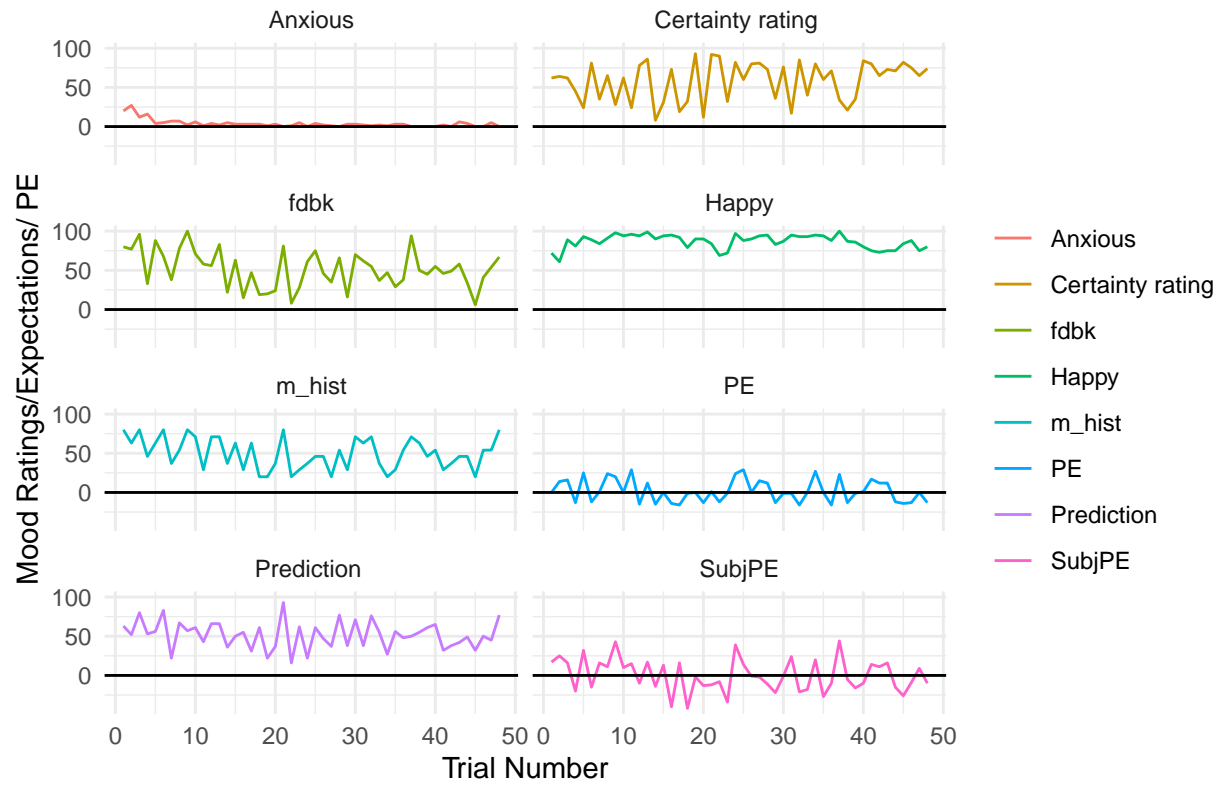
SUPPRF53463
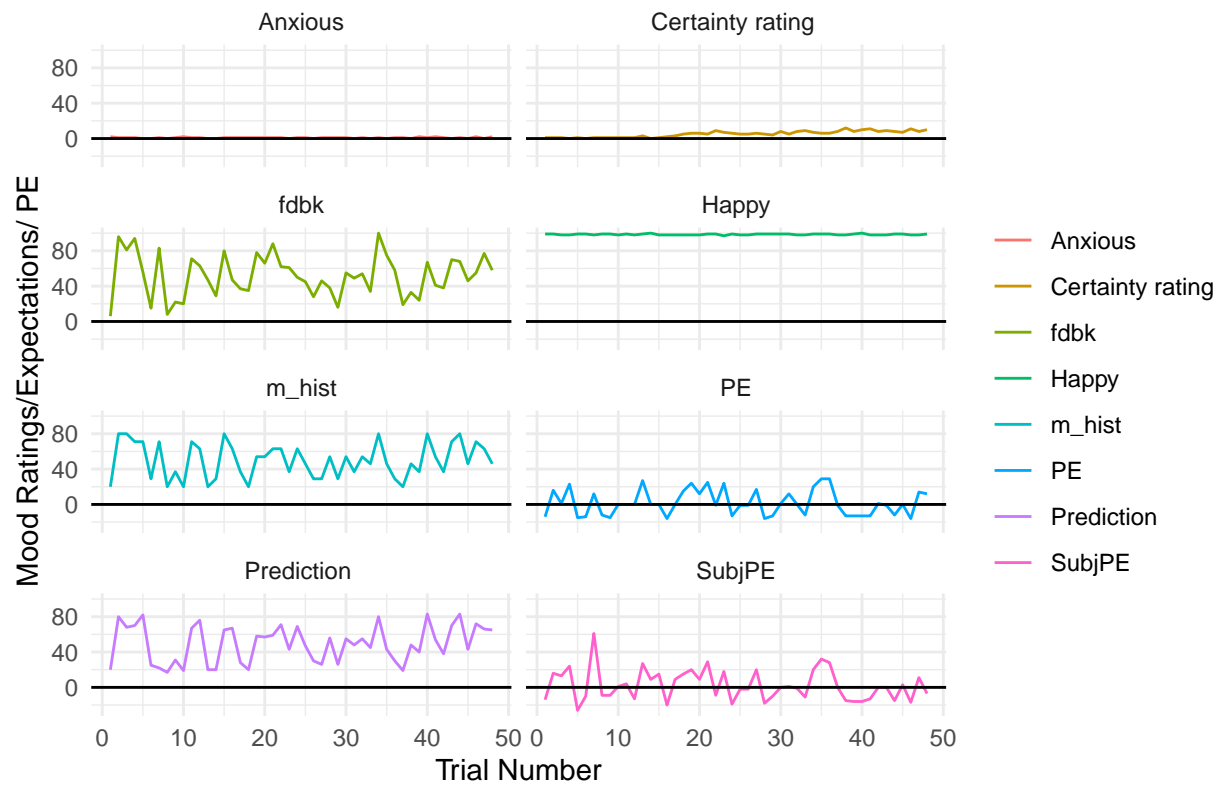
SUPPRF17225
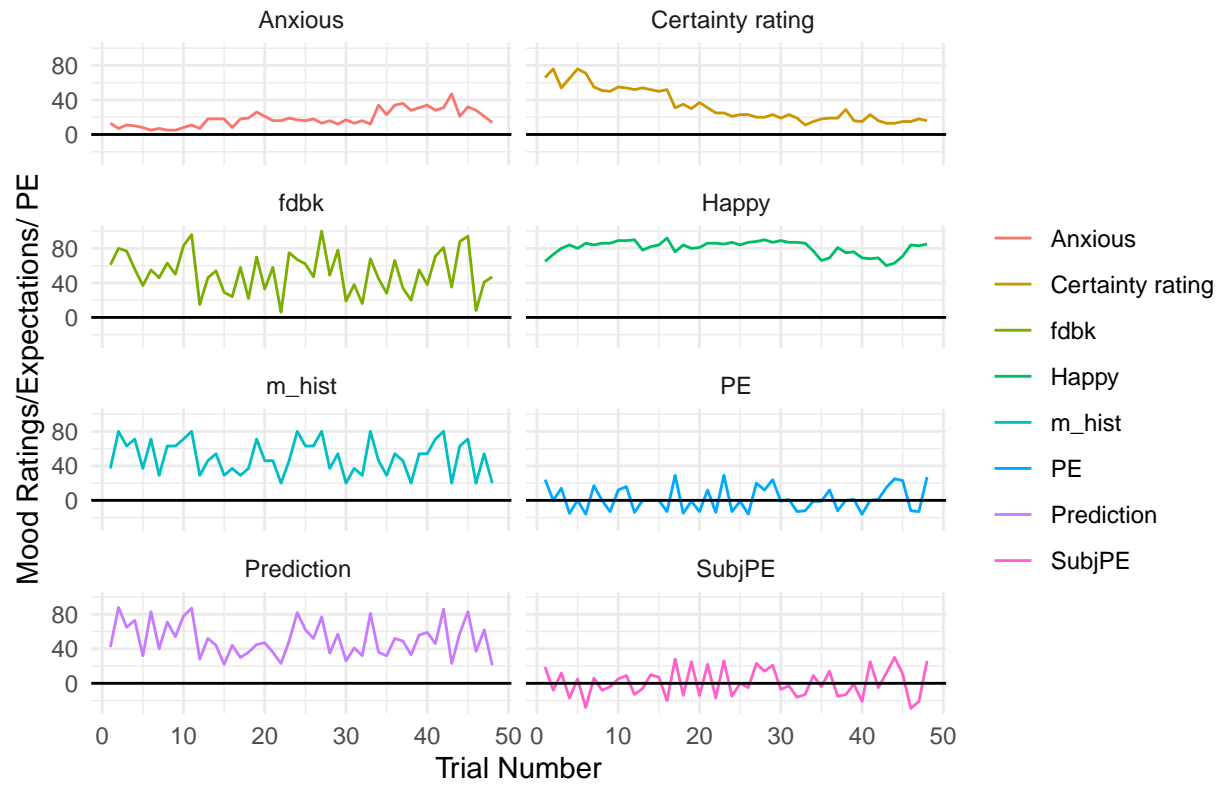
SUPPRF34408
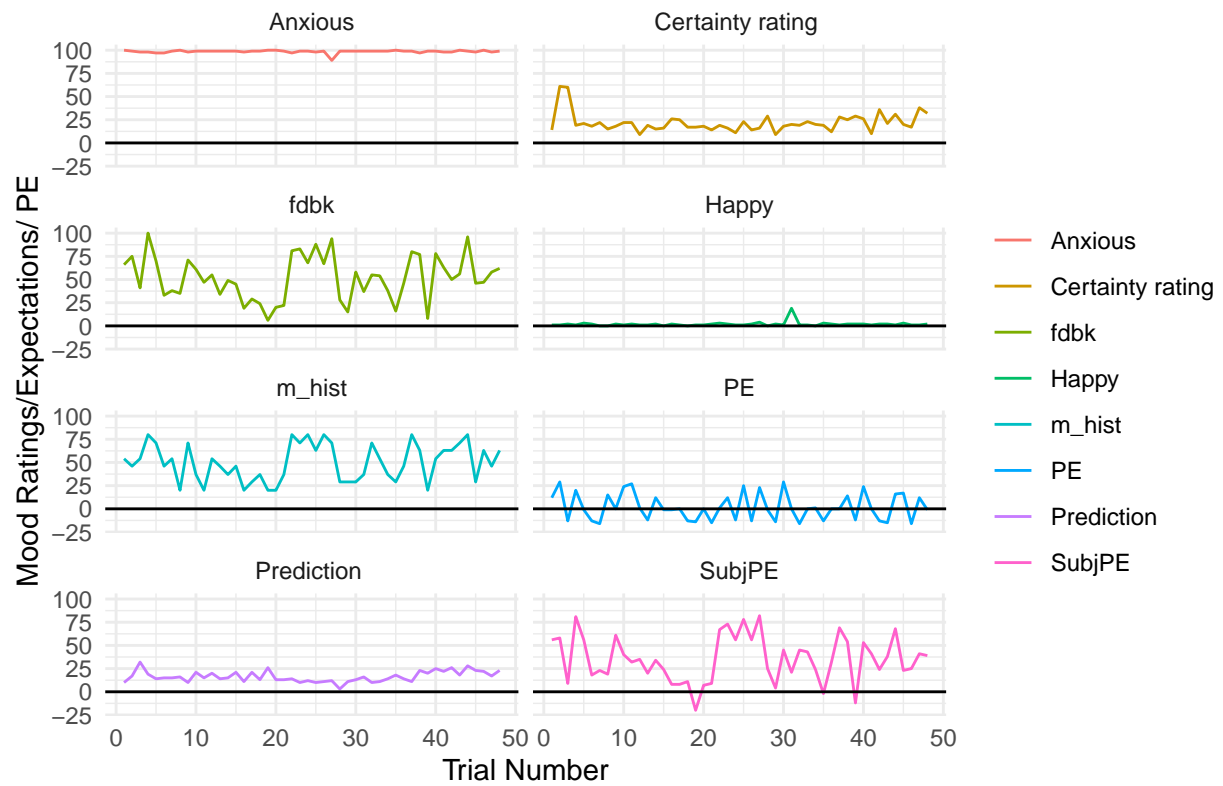
SUPPRF78865
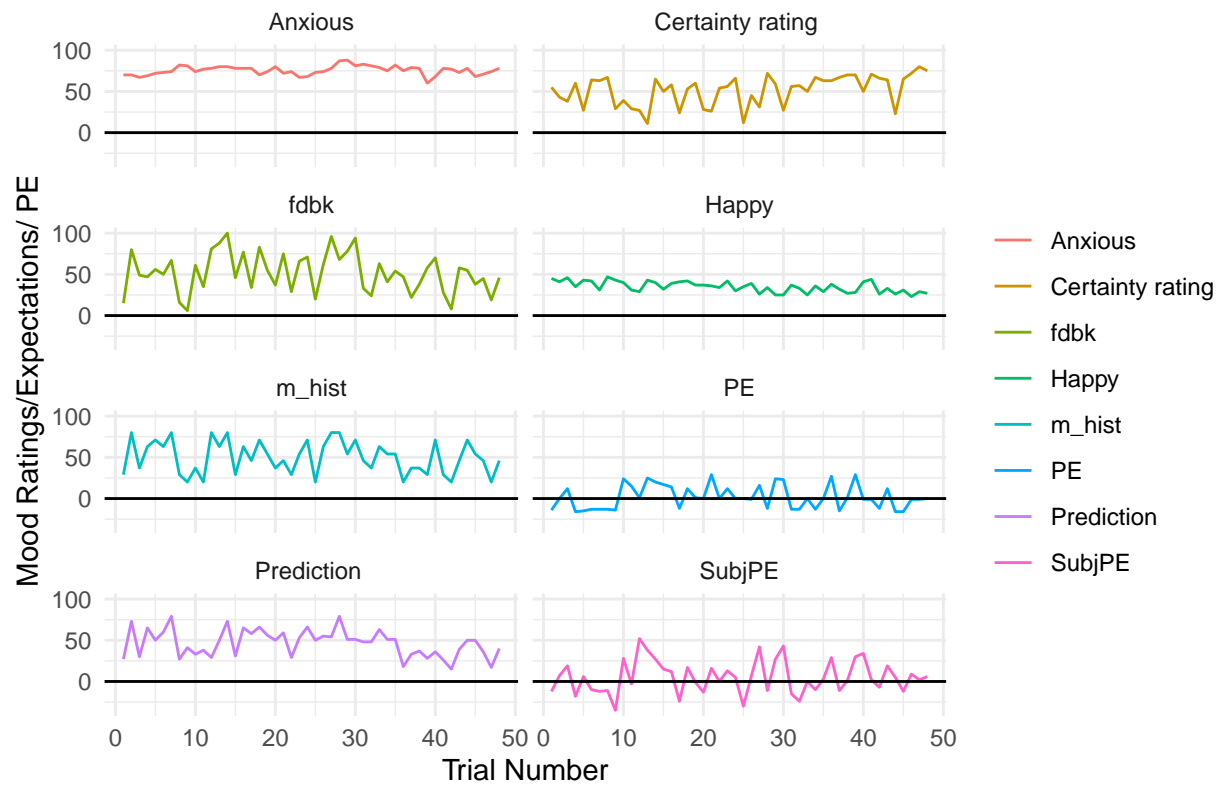
SUPPRF62860
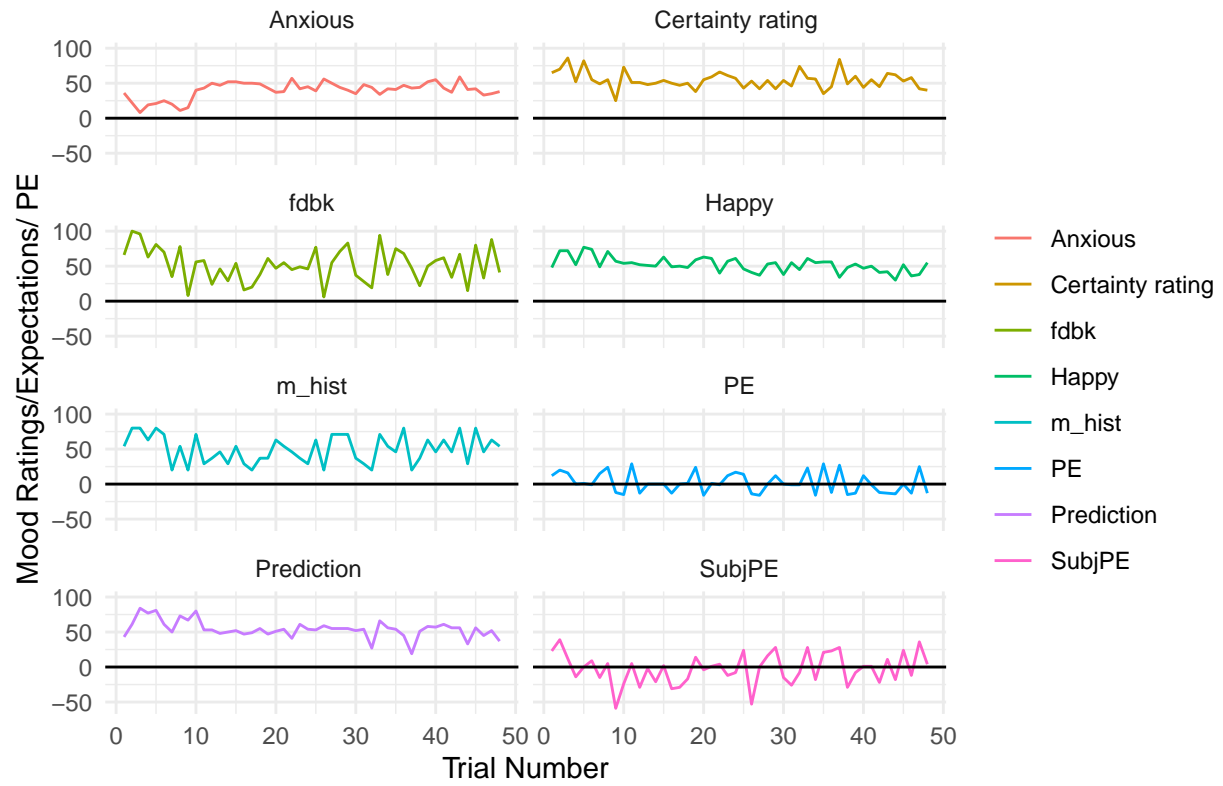
SUPPRF65333
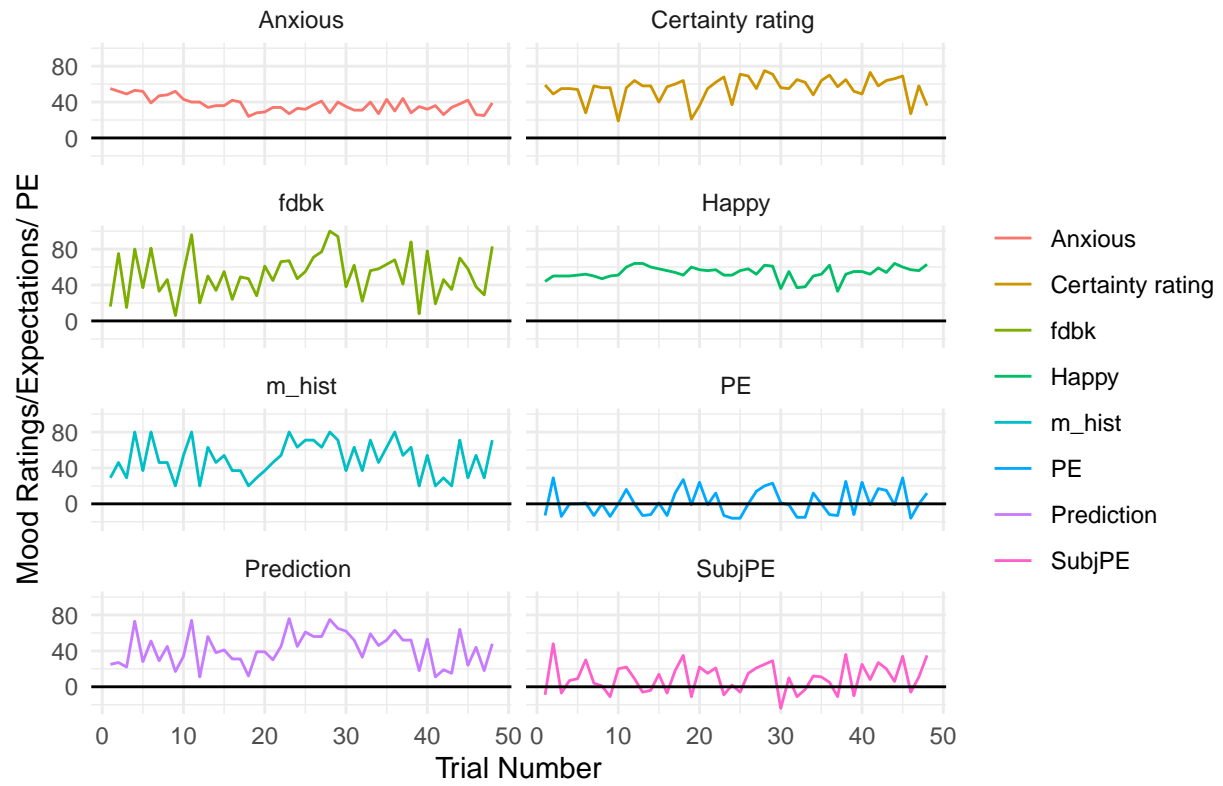
SUPPRF82563
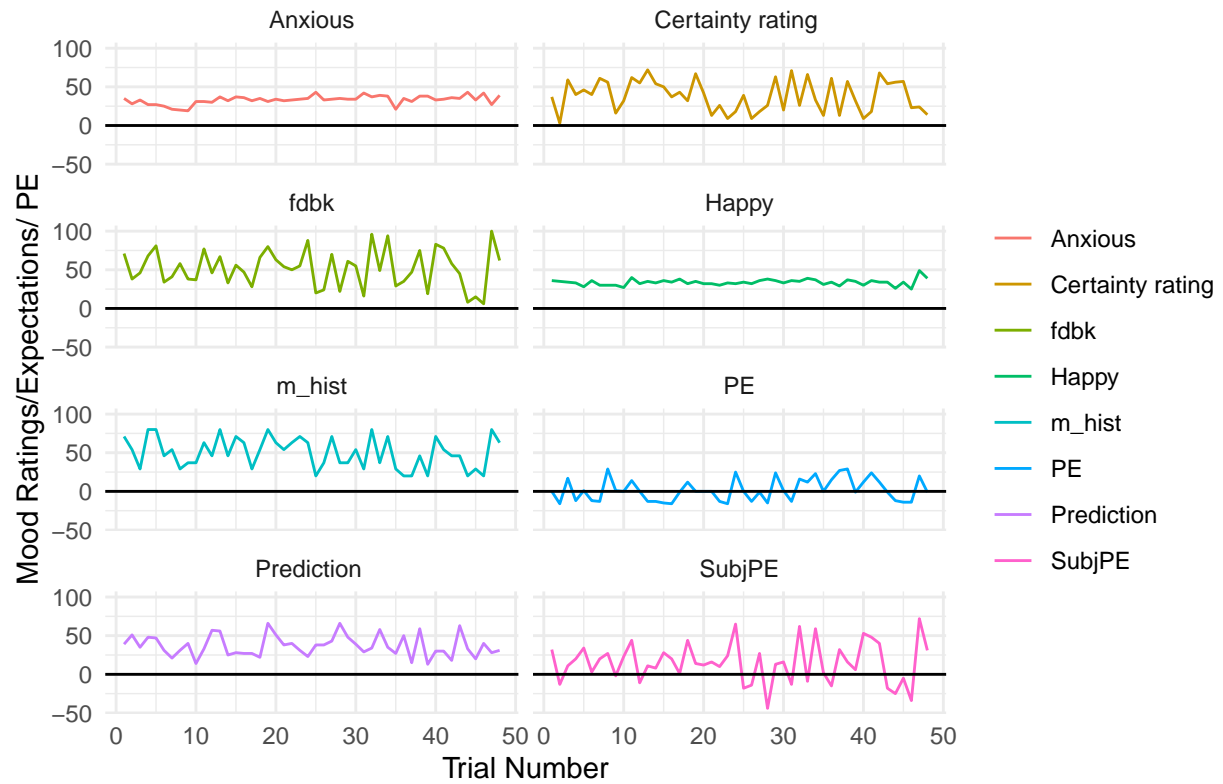
SUPPRF61122
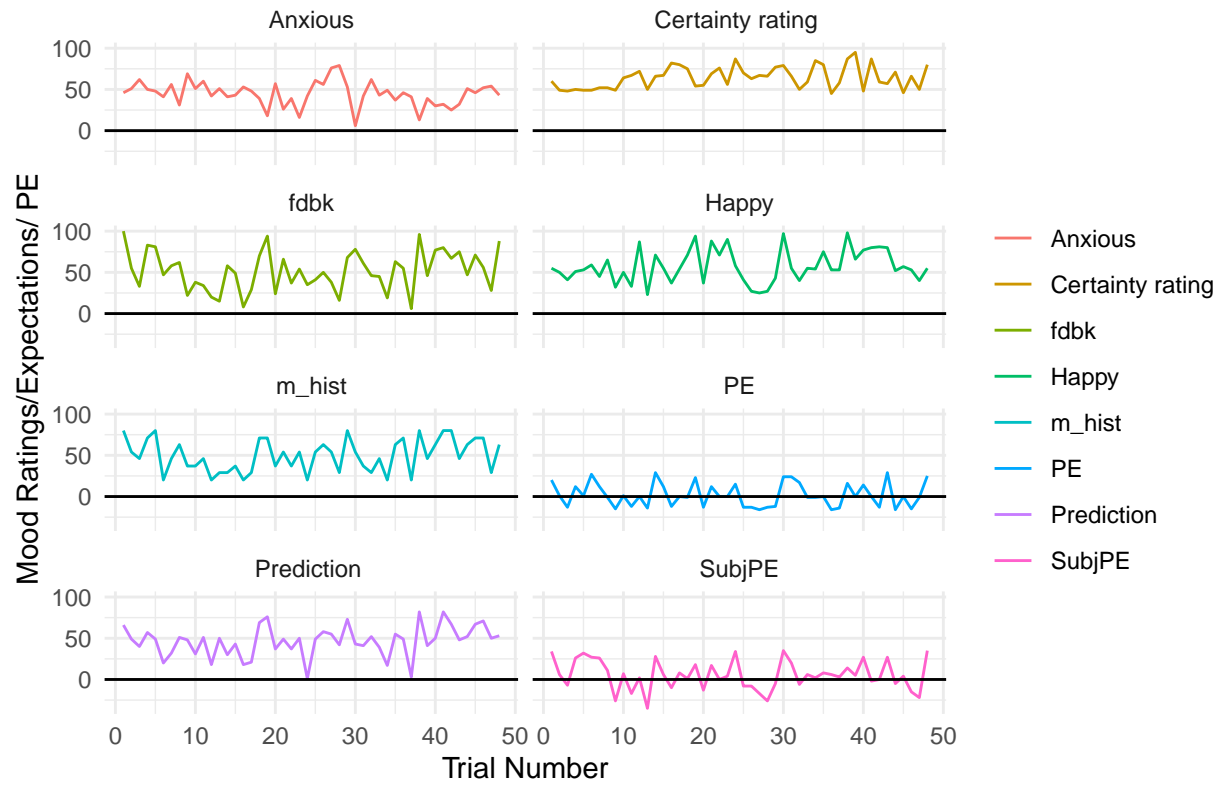
SUPPRF20210
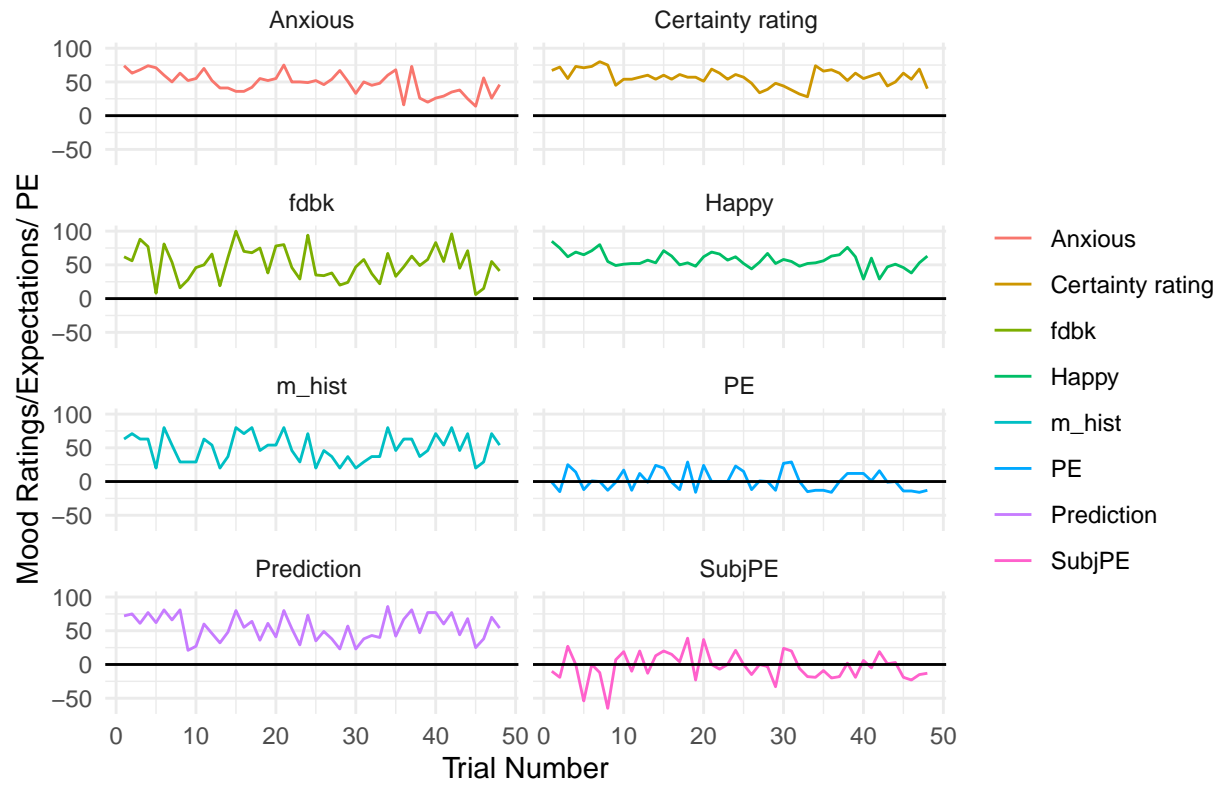
SUPPRF37840
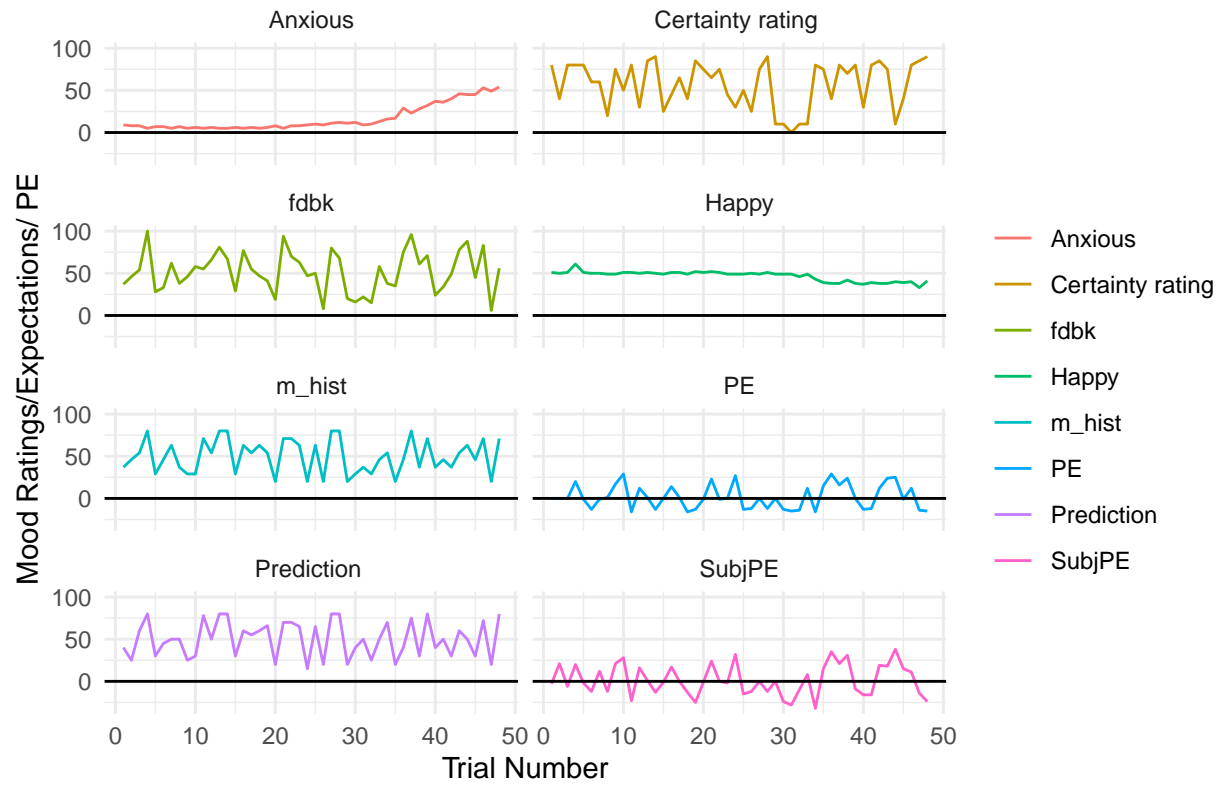
SUPPRF61000
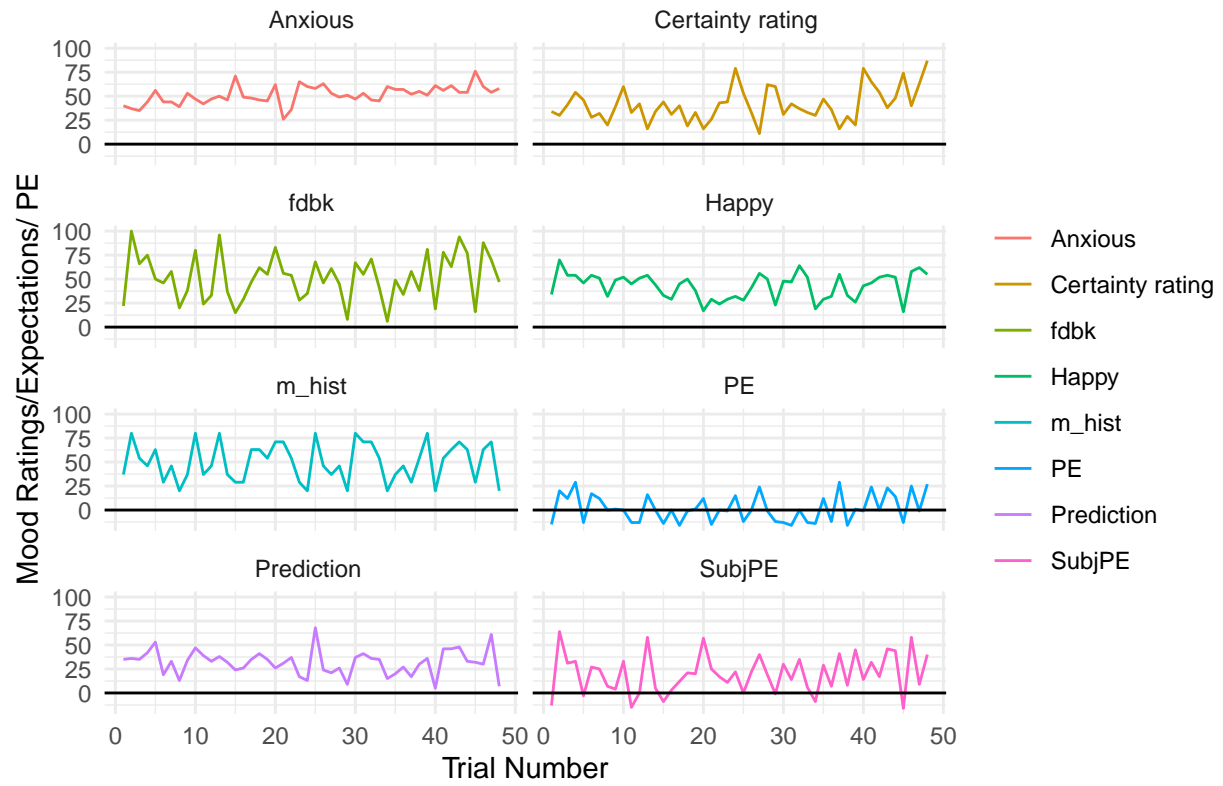
SUPPRF77020
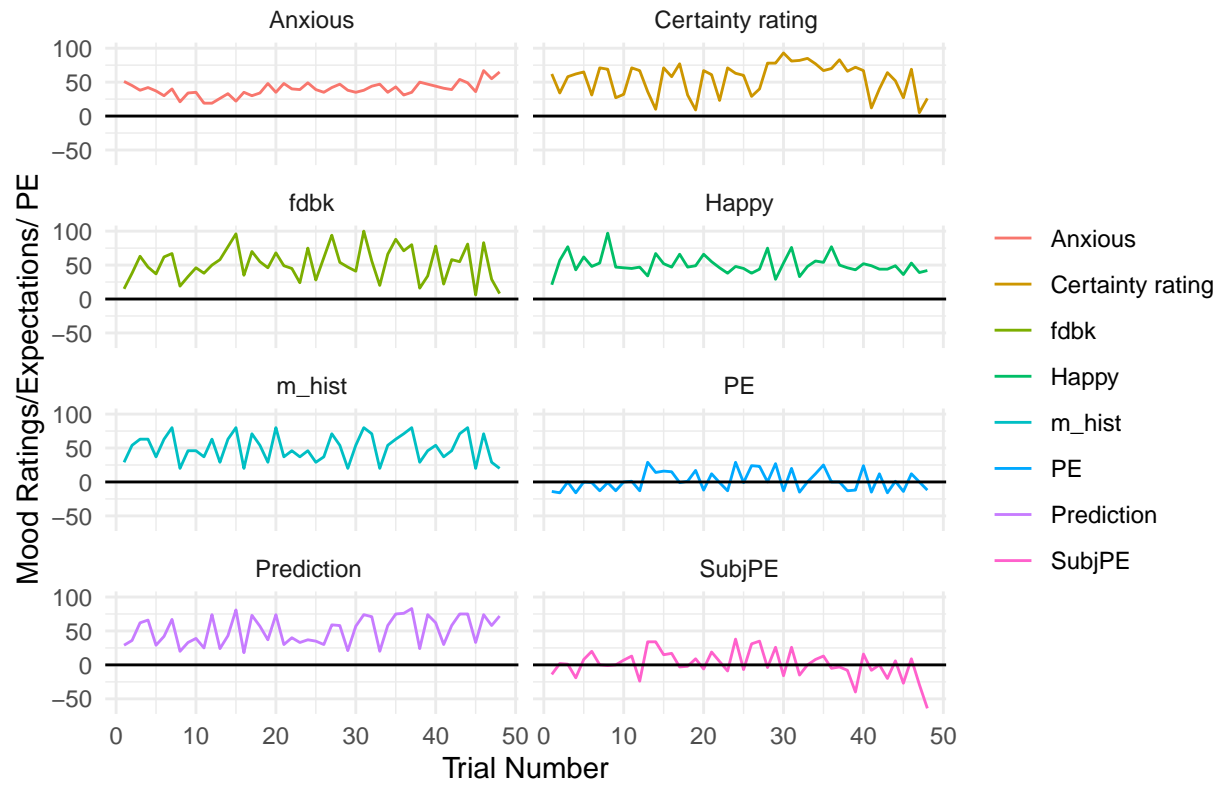
SUPPRF13951
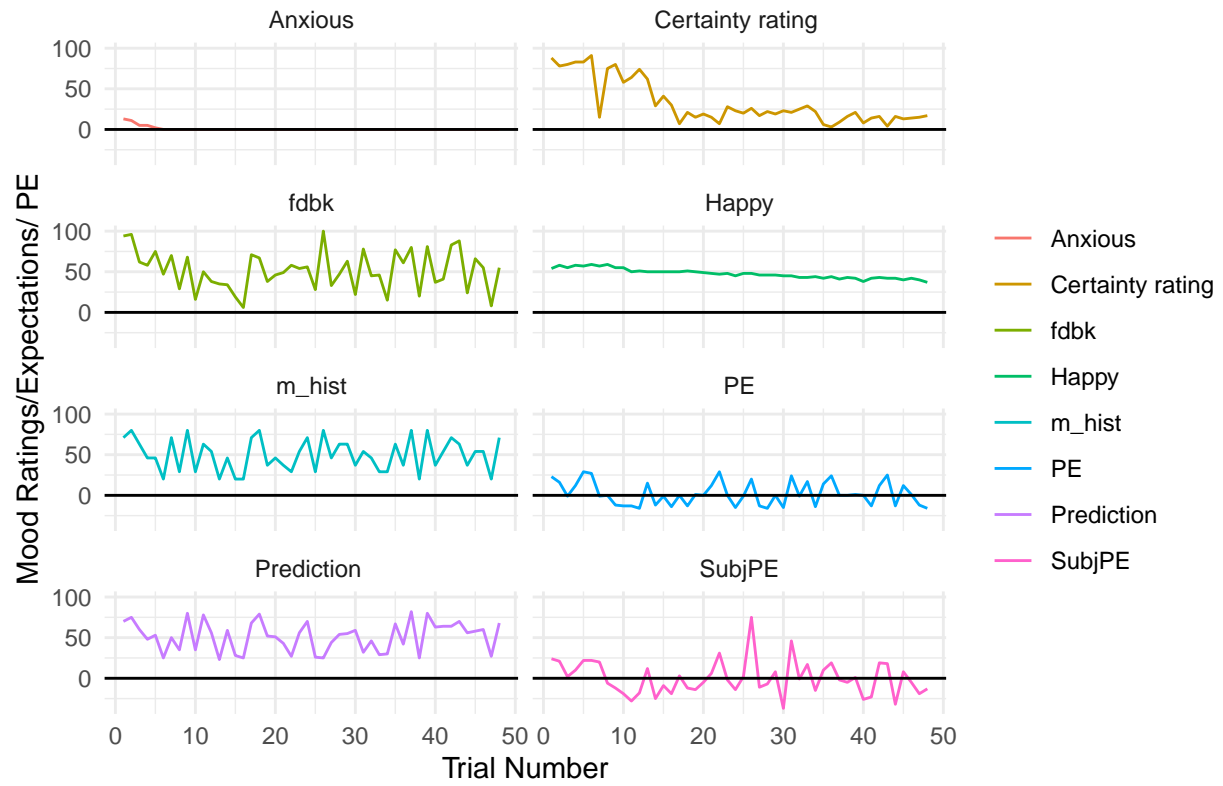
SUPPRF79160
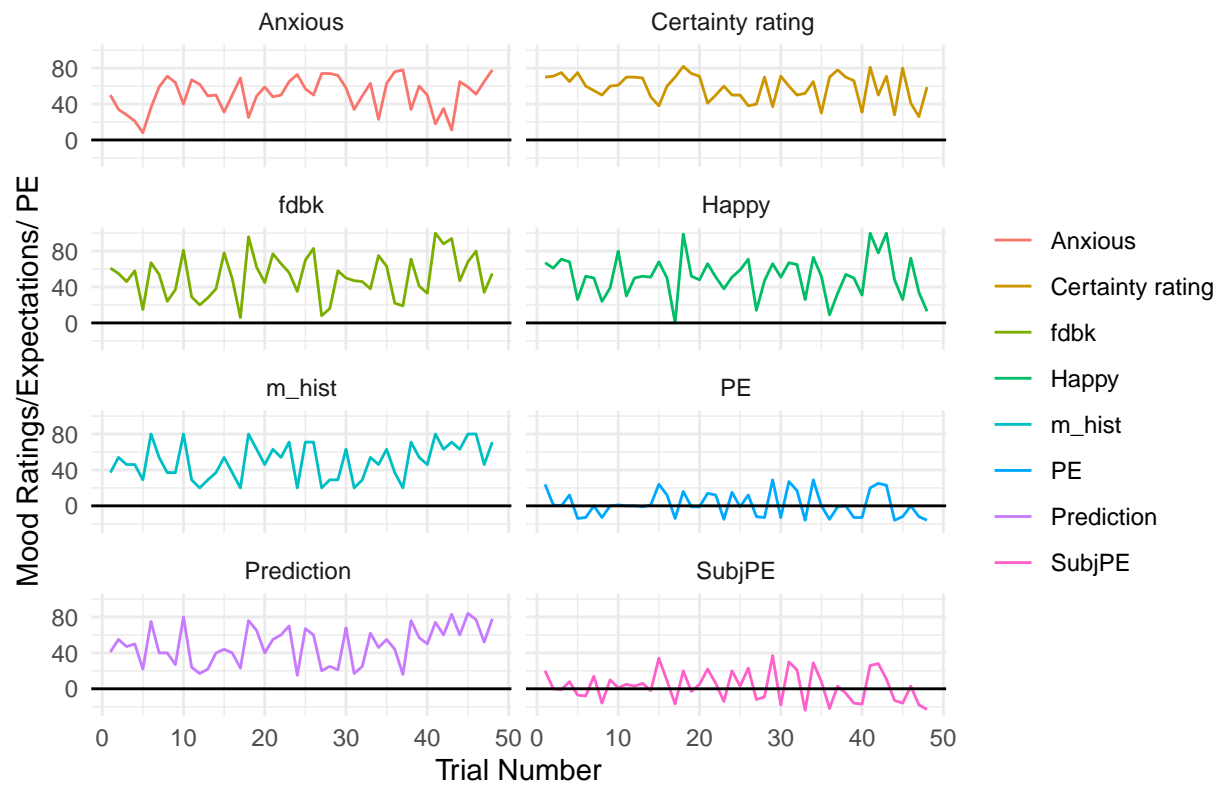
SUPPRF57557
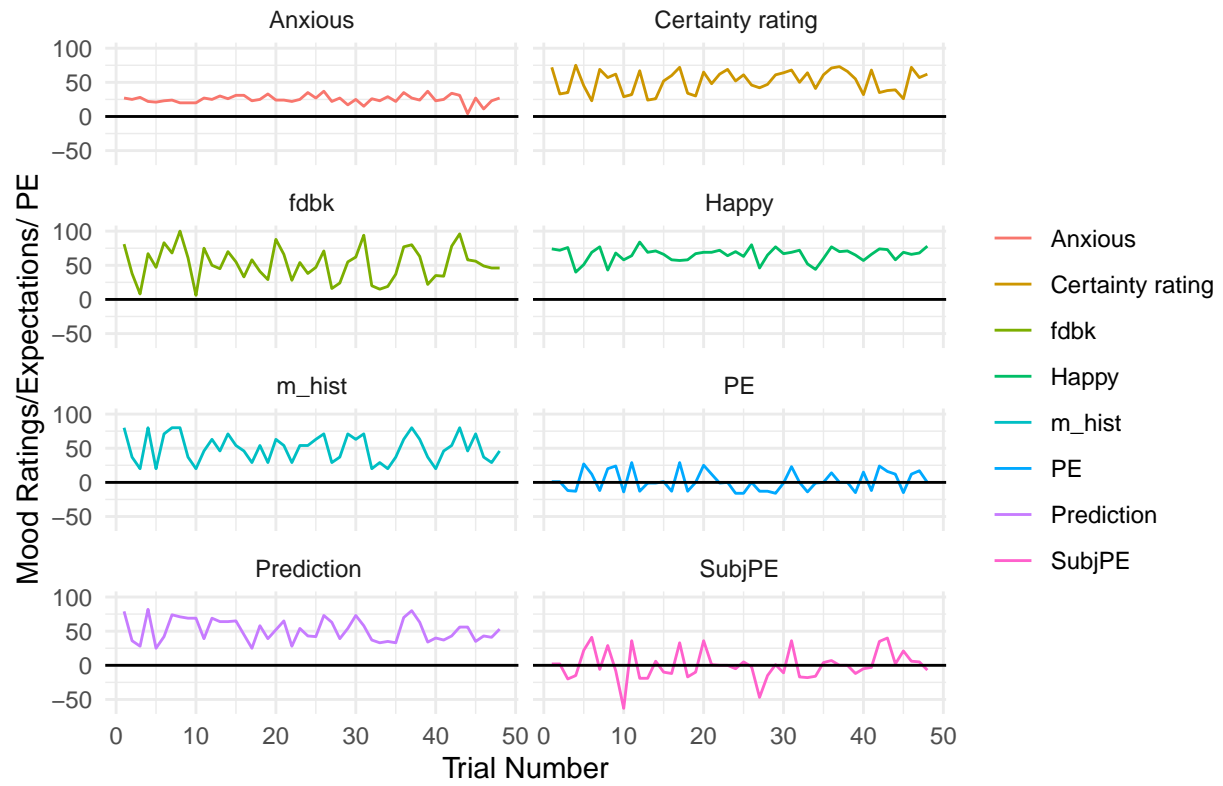
SUPPRF12856
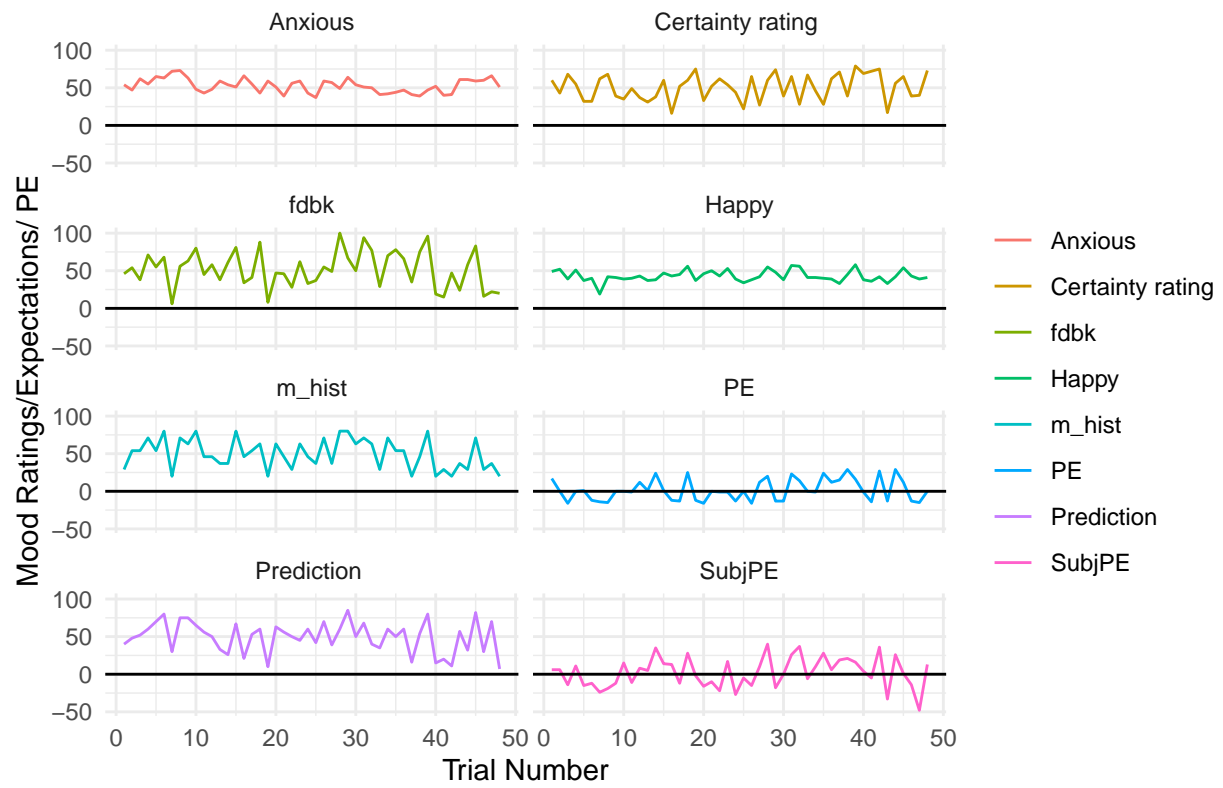
SUPPRF26467
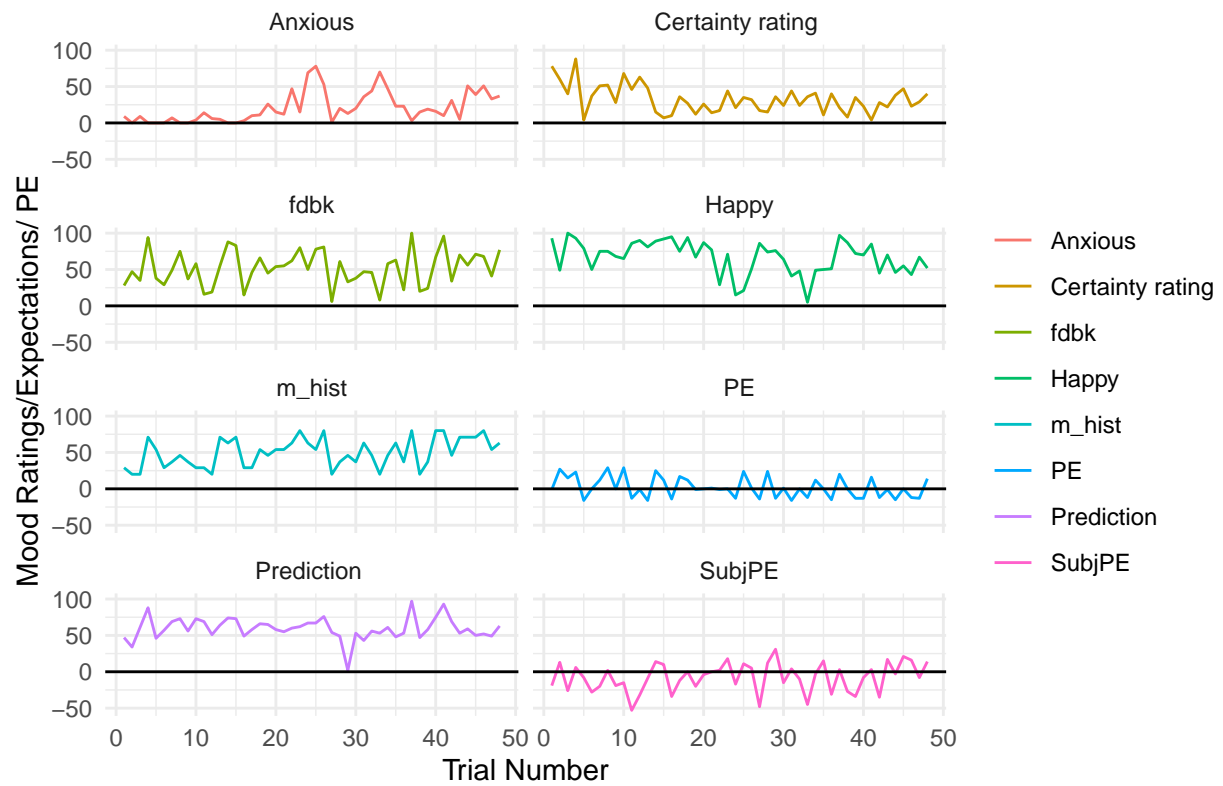
SUPPRF12547
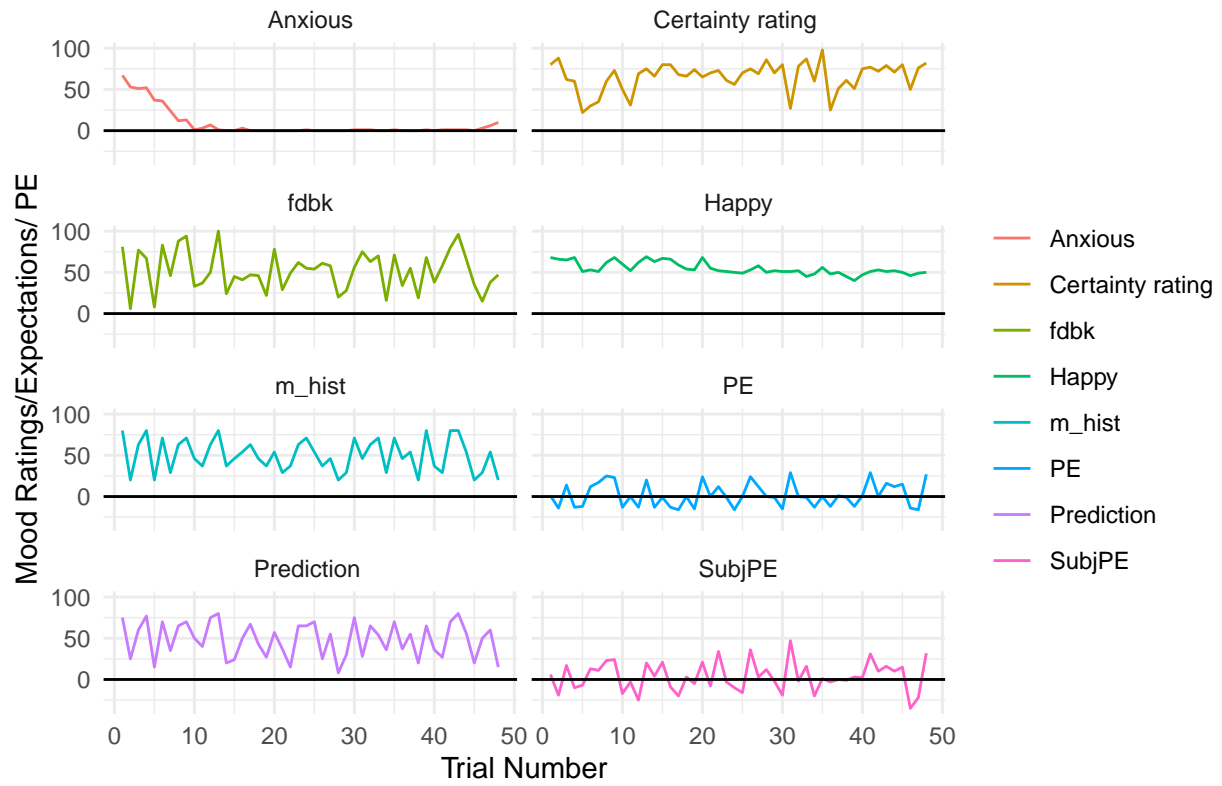
SUPPRF33361
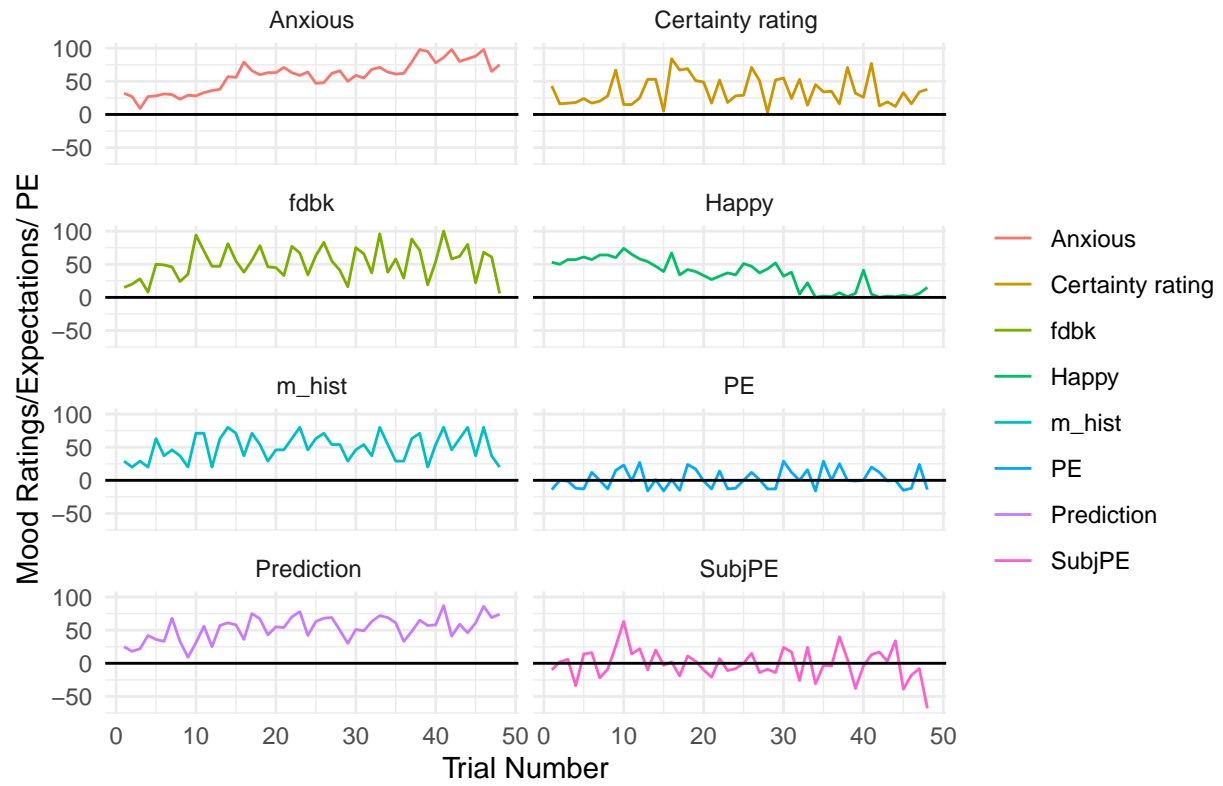
SUPPRF71005
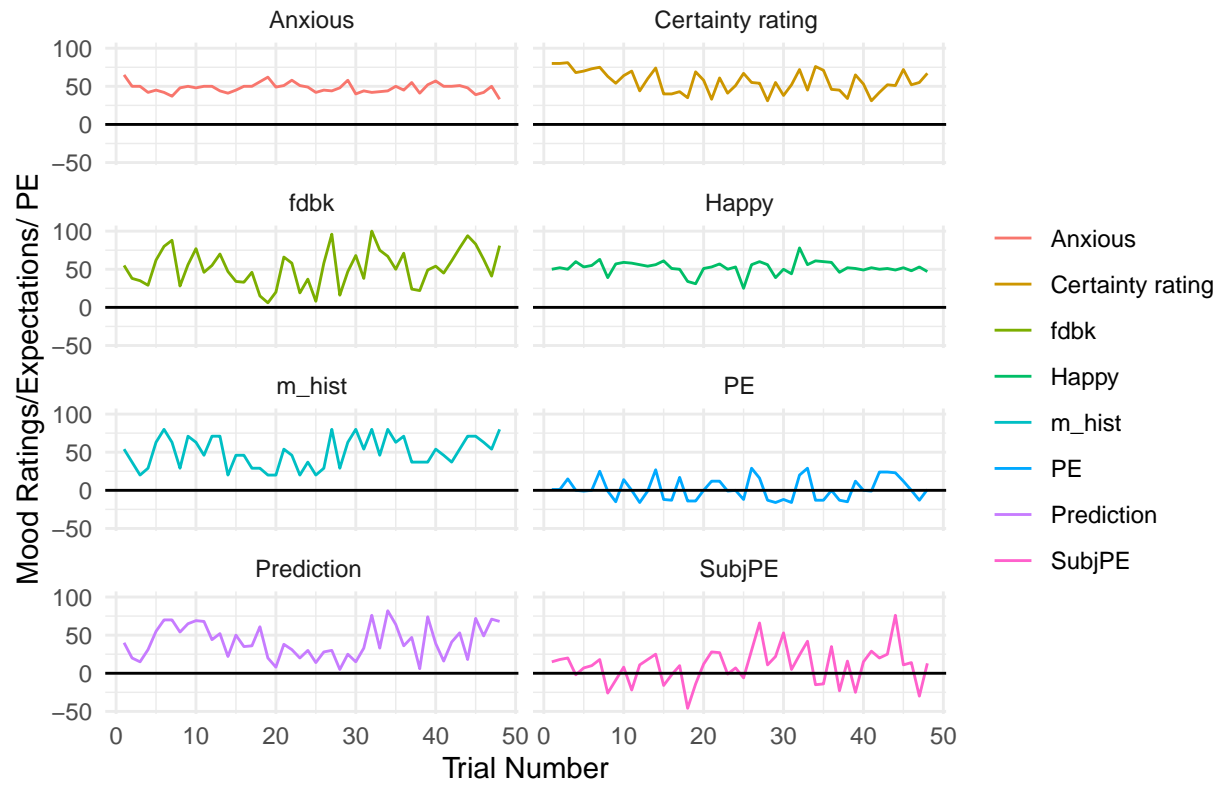
SUPPRF51078
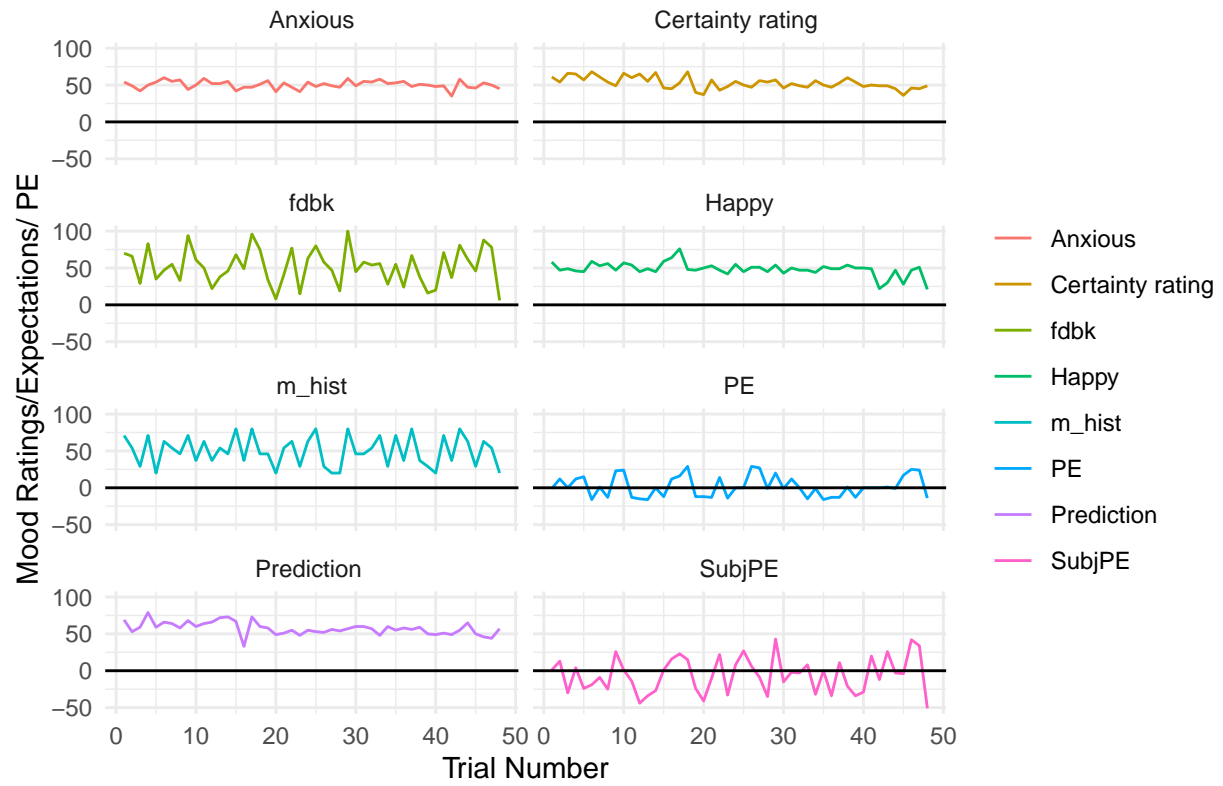
SUPPRF89542
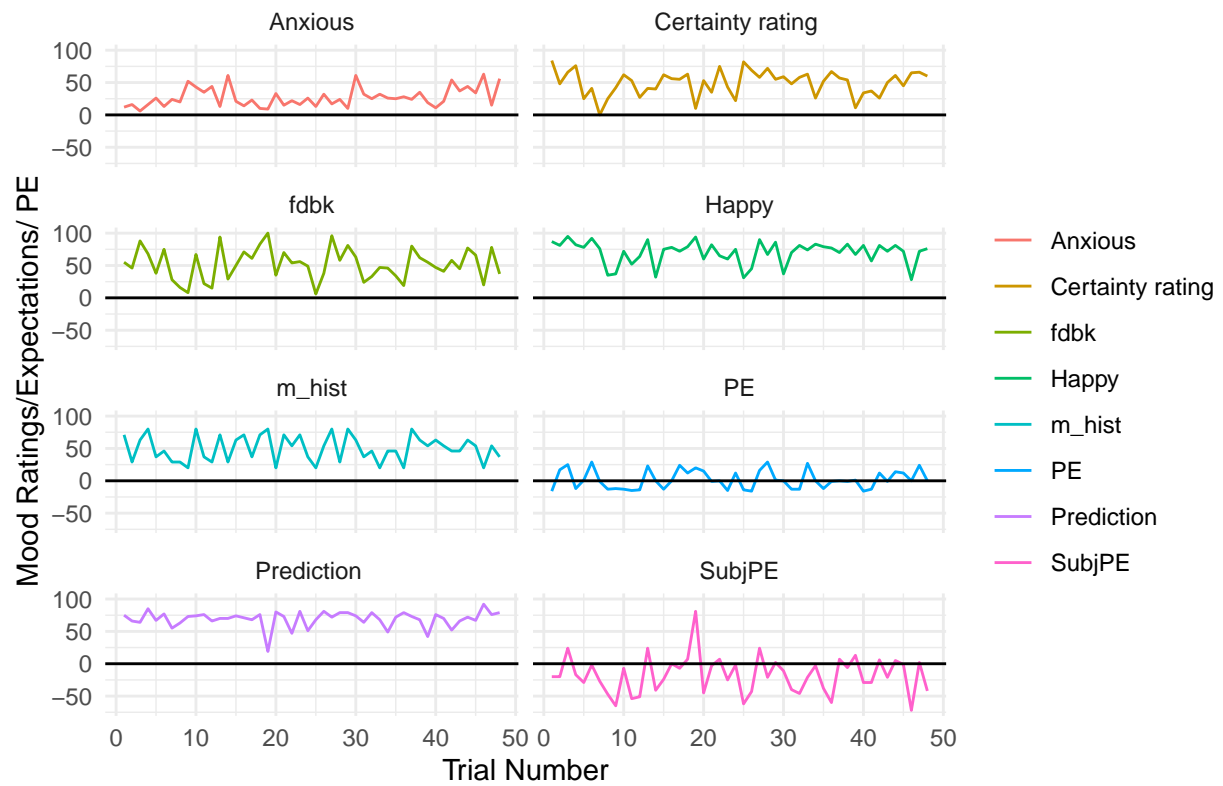
SUPPRF40116
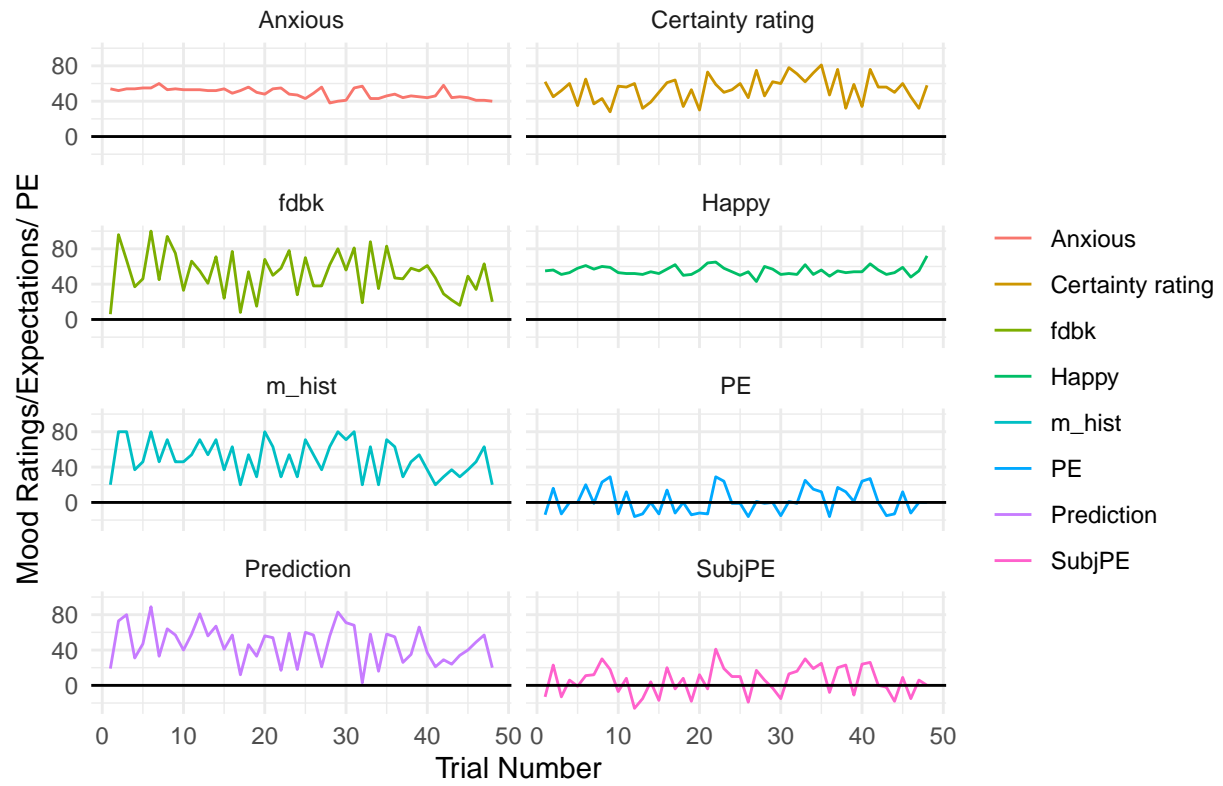
SUPPRF98981
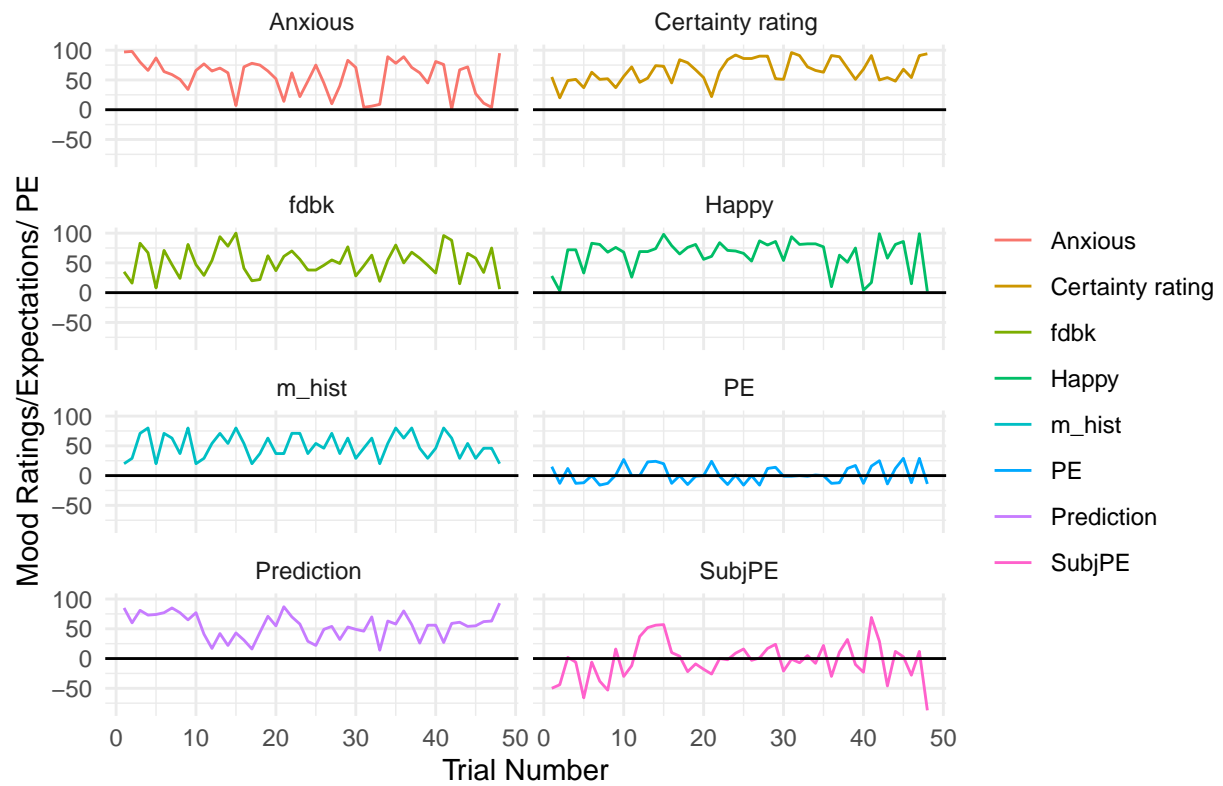
SUPPRF06248
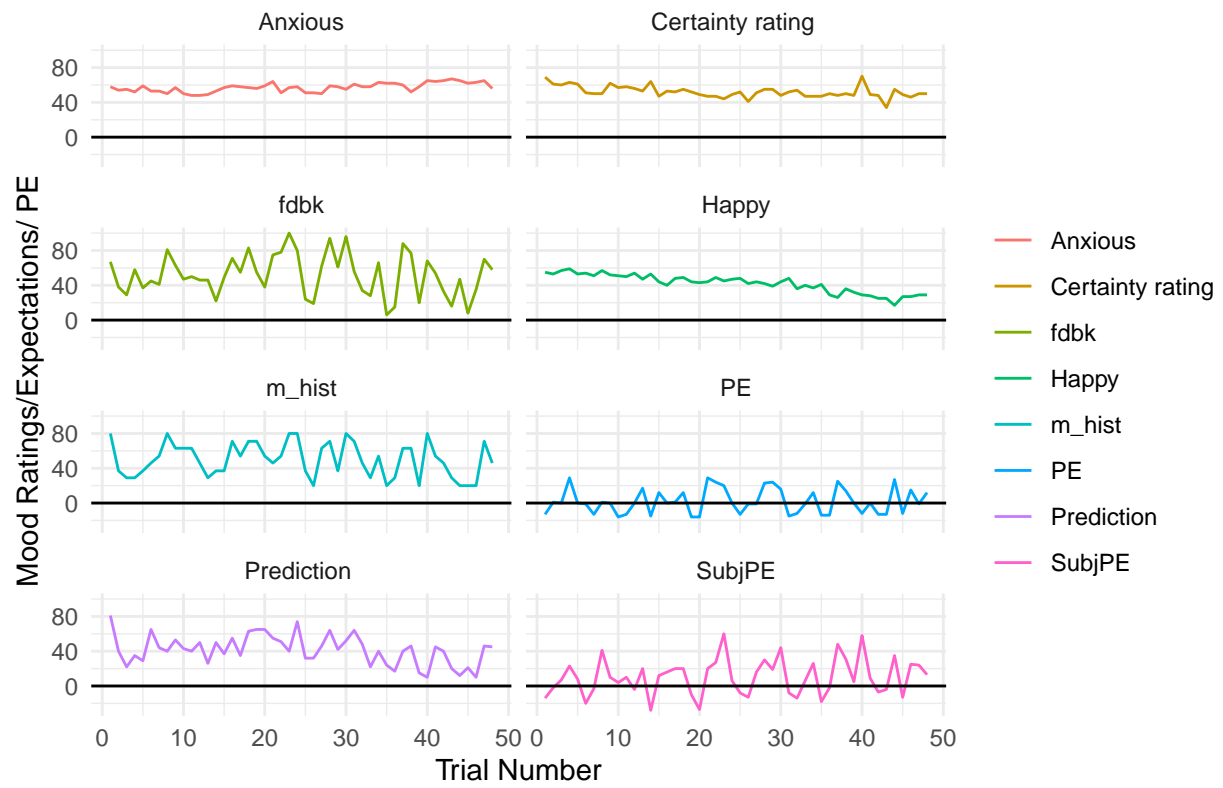
SUPPRF87563
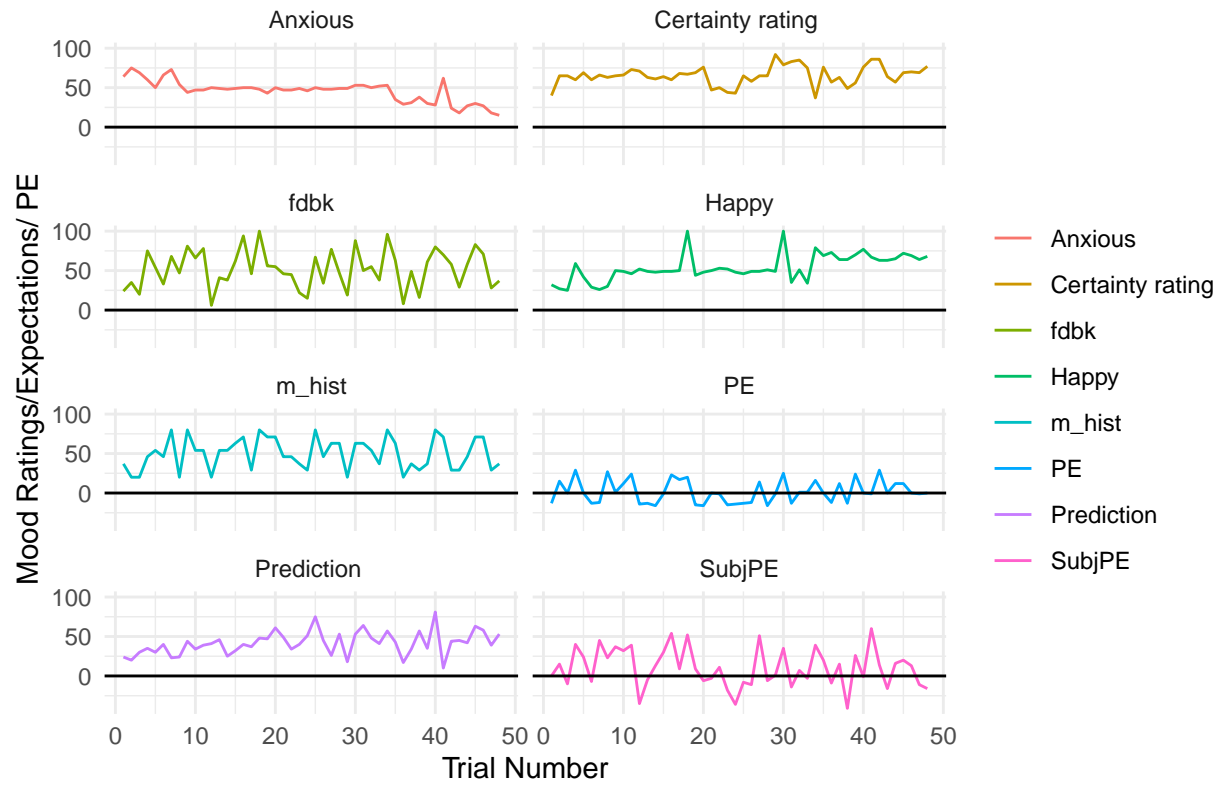
PE and SubjPE relationship

We now look at the relationship between PE (feedback - histogram_mean) and SubjPE (feedback - prediction). The correlation between SubjPE and objective PE remain similar to previous pilots.

```
## [1] "average correlation between PE and SubjPE: 0.686357933098262"
```
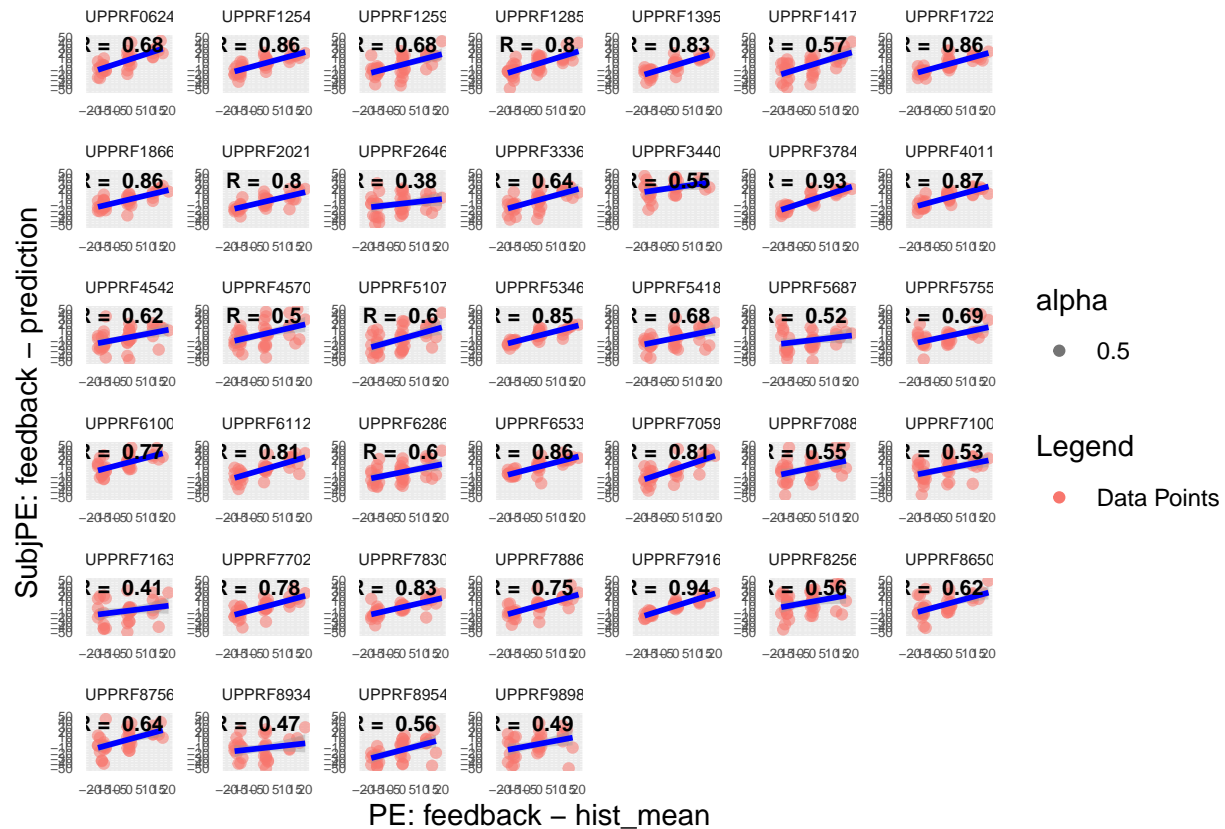
SubjPE and Anxiety relationship

Let's now look at the relationship between SubjPE and Anxiety ratings:

[1] "average correlation between Anxiety and SubjPE: -0.0891129101944432"

I will exclude subject "SUPPRF13951" and "SUPPRF34408", "SUPPRF53463", "SUPPRF54185", "SUP-PRF56870" who rated always 0 or 100 for anxiety. After repeating the previous plot and correlations without them, the correlation becomes -0.10 from -0.09. I will add them back in.

[1] "average correlation between Anxiety and SubjPE: -0.100044677288319"
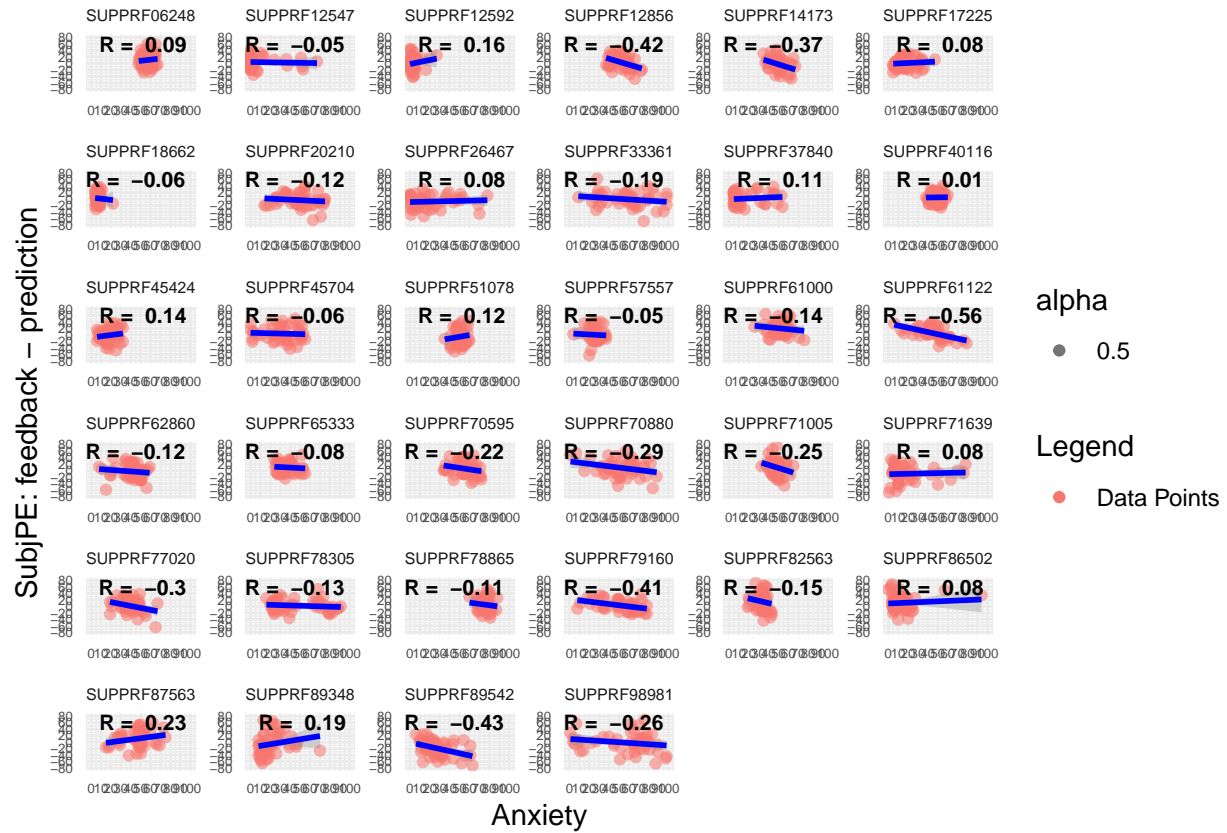
SubjPE and Anxiety

Let's look at the same relationship for mood and subjPE:

[1] "average correlation between Mood and SubjPE: 0.180251962174898"

I will remove subjects "SUPPRF34408" and "SUPPRF53463" who again rated 0 or 100. Let's look at the same relationship for mood and subjPE without these people. The correlation increases to 0.21 from 0.18.

```
## [1] "average correlation between Mood and SubjPE: 0.194867474595861"
```
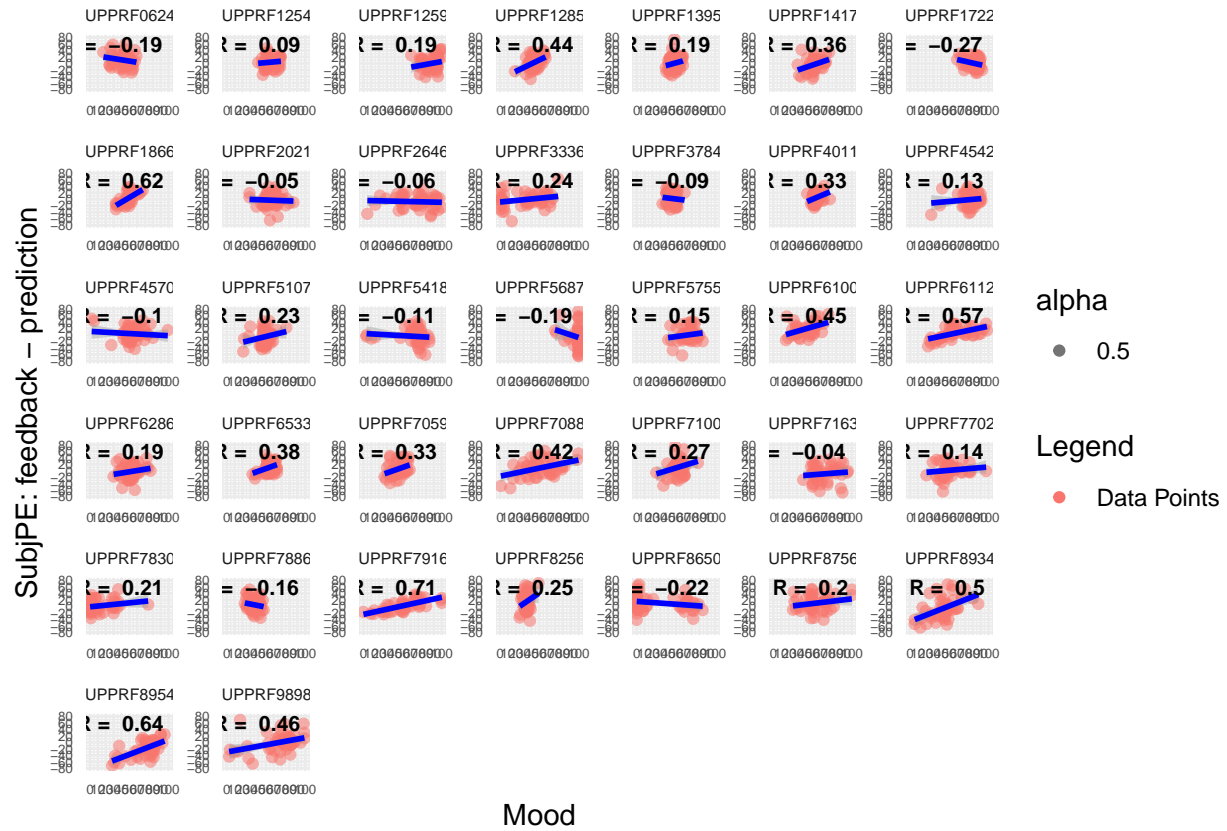
The correlation for mood is less than before (0.18/0.21 vs 0.26), and consistently higher than anxiety (which is the same as before despite changing the wording of the question). We now will look whether the average correlations are significantly different from zero for both anxiety and mood.

```
## [1] "corr Anxiety and SubjPE"
```

```
##
##  One Sample t-test
##
## data:  correlations_Ax_SubPE$correlation
## t = -2.8832, df = 33, p-value = 0.006879
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -0.17064167 -0.02944768
## sample estimates:
##  mean of x
## -0.1000447
```

```
## [1] "corr happiness and SubjPE"
```

```
##
##  One Sample t-test
##
## data:  correlations_H_SubPE$correlation
## t = 4.4922, df = 36, p-value = 7.008e-05
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.1068905 0.2828444
## sample estimates:
## mean of x
## 0.1948675
```

Histogram for PE, SubjPE, feedback, hist_m

Let's have a look at histograms of SubjPE, PE, feedback and histogram means:

Histogram of Responses
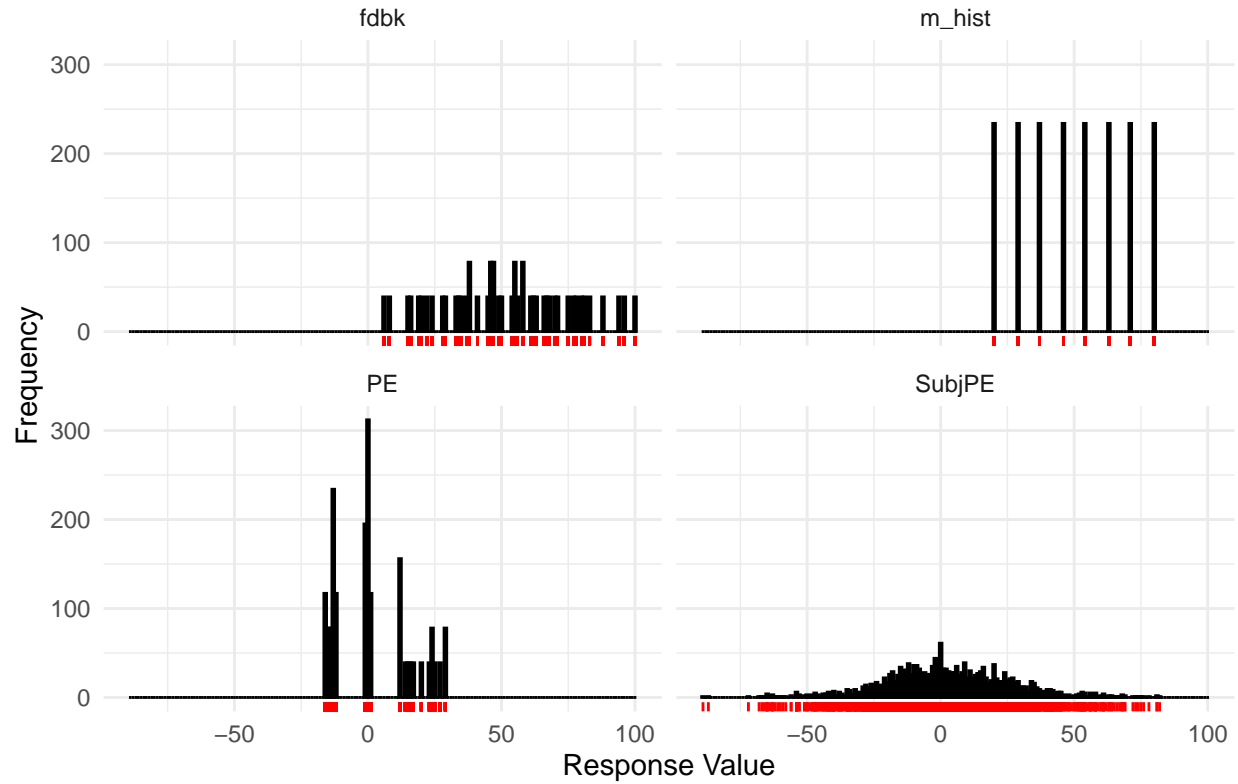
Histogram for anxiety ratings

We have again less variability in anxiety ratings, so the previous pilot was not because we changed the question!
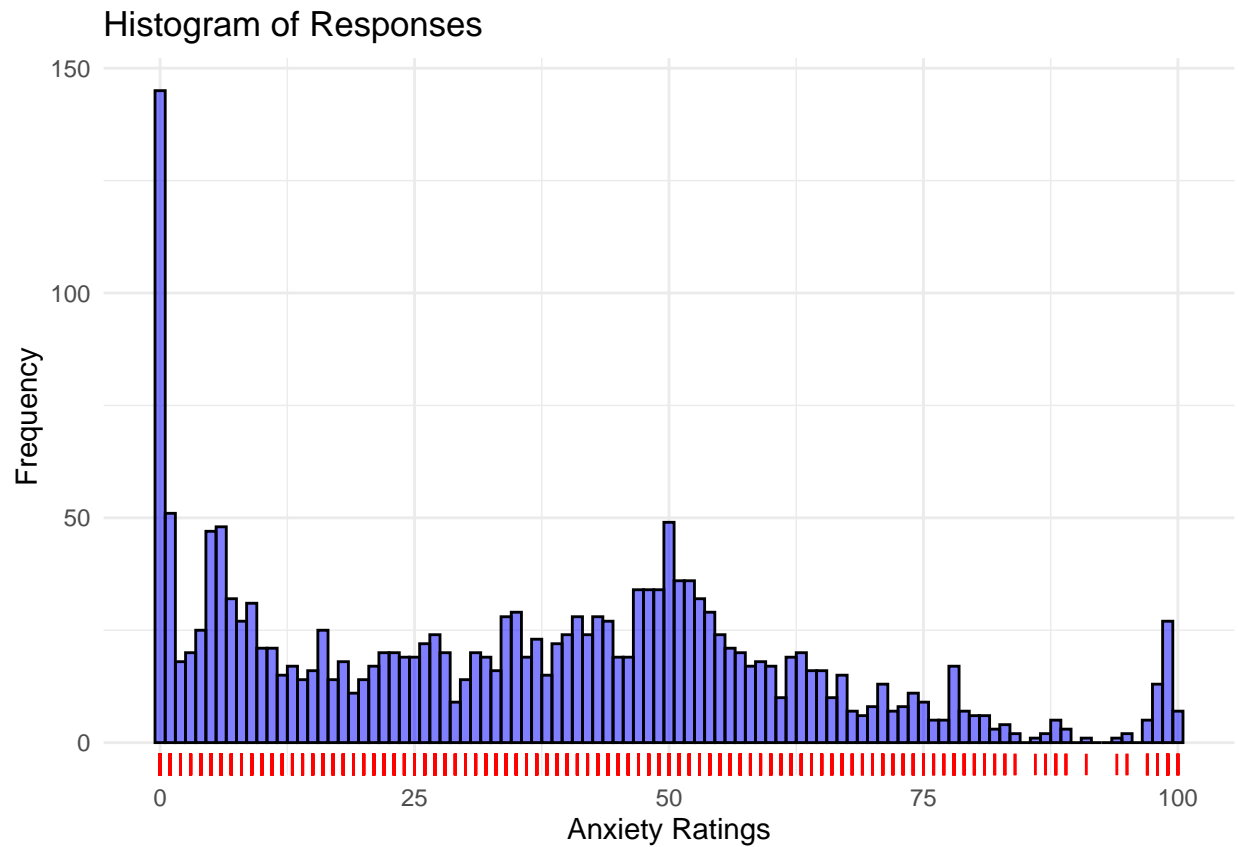
Histogram for mood ratings

Histogram of Responses
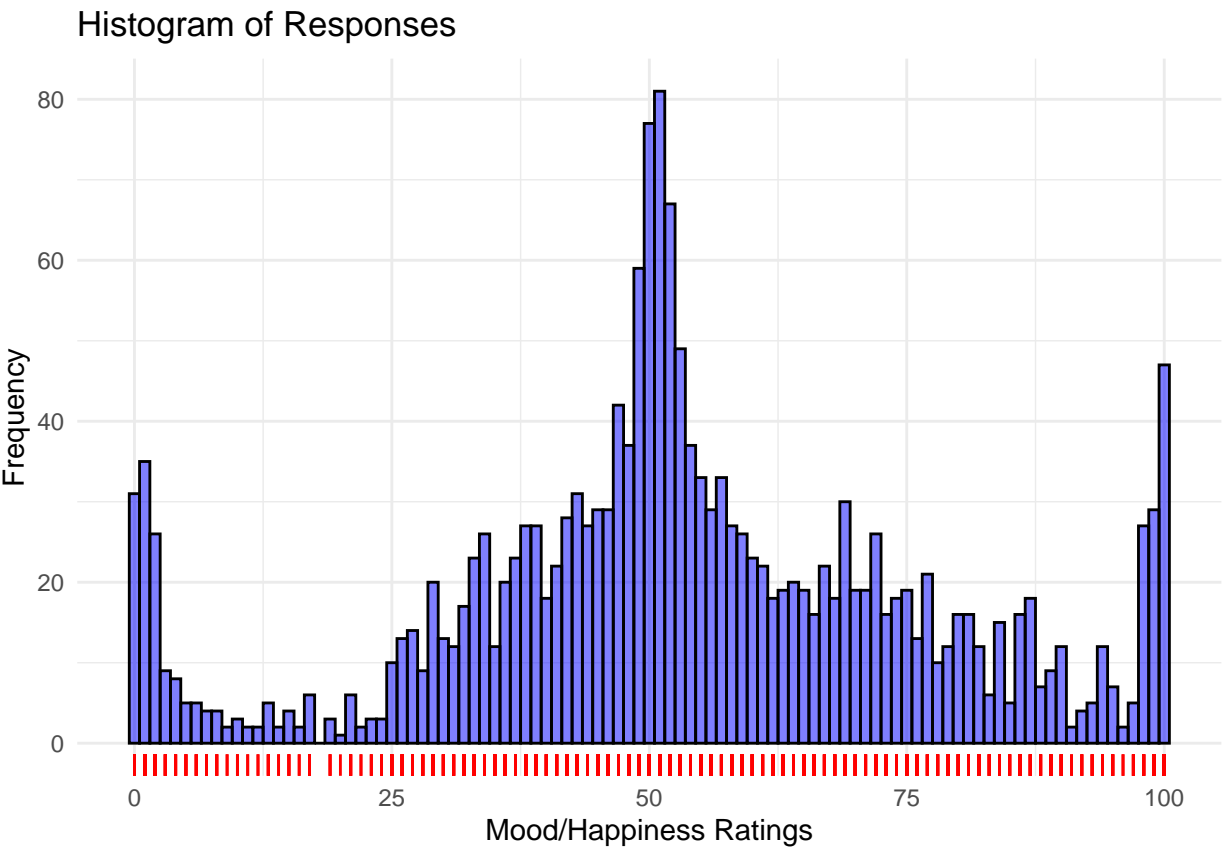
ICC and LME models for mood and anxiety

we will now look at the ICC outcome for anxiety The ICC is lower than the study without feedback (which was 0.80), it is moderate according to guidelines by Koo and Li (2016): below 0.50: poor between 0.50 and 0.75: moderate between 0.75 and 0.90: good above 0.90: excellent

```
## [1] "lmer for anxiety with just the intercept"
```

```
## [1] 0.7465389
```

```
##                 2.5 %    97.5 %
## .sig01       17.92998 28.10639
## .sigma       12.62812 13.47283
## (Intercept)  28.32054 42.58438
```

```
## [1] 15120.9
```

```
## [1] 15113.18
```

```
## Data: final_df10
## Models:
## model1: Response_Ax ~ 1 + (1 | Random_ID)
## model2: Response_Ax ~ Response_PE + (1 | Random_ID)
##        npar   AIC   BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model1    3 15125 15142 -7559.6    15119
## model2    4 15112 15134 -7551.9    15104 15.583  1  7.895e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## [1] 15113.95
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Response_Ax ~ Response_SubjPE + (1 | Random_ID)
##    Data: final_df10
##
## REML criterion at convergence: 15105.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.0822 -0.4630 -0.0345  0.3571  6.2550
##
## Random effects:
##  Groups    Name        Variance Std.Dev.
##  Random_ID (Intercept) 511.7    22.62
##  Residual              168.6    12.98
## Number of obs: 1872, groups:  Random_ID, 39
##
## Fixed effects:
##                  Estimate Std. Error t value
## (Intercept)      35.59988    3.63472   9.794
## Response_SubjPE  -0.05399    0.01359  -3.973
##
```

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```
## Correlation of Fixed Effects:
##           (Intr)
## Rspns_SbjPE -0.010


## Data: final_df10
## Models:
## model1: Response_Ax ~ 1 + (1 | Random_ID)
## model3: Response_Ax ~ Response_SubjPE + (1 | Random_ID)
##        npar   AIC   BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model1    3 15125 15142 -7559.6    15119
## model3    4 15112 15134 -7551.8    15104 15.691  1  7.456e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


## Data: final_df10
## Models:
## model2: Response_Ax ~ Response_PE + (1 | Random_ID)
## model3: Response_Ax ~ Response_SubjPE + (1 | Random_ID)
##        npar   AIC   BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model2    4 15112 15134 -7551.9    15104
## model3    4 15112 15134 -7551.8    15104 0.1082  0


##               2.5 %   97.5 %
## .sig01      17.92998 28.10639
## .sigma      12.62812 13.47283
## (Intercept) 28.32054 42.58438


## [1] "lmer for anxiety with just the intercept"


## [1] 0.7465389
```

The ICC outcome for mood: The ICC is moderate according to guidelines by Koo and Li (2016).

```
## [1] "lmer for mood with just the intercept"
```

```
## [1] 0.6437434
```

```
##                  2.5 %   97.5 %
## .sig01       15.34013 24.09587
## .sigma       13.81085 14.73467
## (Intercept) 47.29225 59.53788
```

```
## [1] 15437.52
```

```
## [1] 15384.58
```

```
## Data: final_df10
## Models:
## model0: Response_H ~ 1 + (1 | Random_ID)
## model1: Response_H ~ Response_SubjPE + (1 | Random_ID)
##        npar   AIC   BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model0    3 15442 15458 -7717.8    15436
## model1    4 15382 15404 -7687.1    15374 61.486  1  4.459e-15 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: Response_H ~ Response_SubjPE + (Response_SubjPE | Random_ID)
##    Data: final_df10
## Control: lmerControl(optimizer = "bobyqa")
##
##      AIC      BIC   logLik deviance df.resid
##  15292.1  15325.3  -7640.0  15280.1     1866
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.3899 -0.4299  0.0201  0.4616  4.5245
##
## Random effects:
##  Groups    Name            Variance Std.Dev. Corr
##  Random_ID (Intercept)     365.9256 19.1292
##            Response_SubjPE   0.0355  0.1884  -0.05
##  Residual                  180.2017 13.4239
## Number of obs: 1872, groups:  Random_ID, 39
##
## Fixed effects:
##                 Estimate Std. Error t value
## (Intercept)     53.22371    3.08091  17.275
## Response_SubjPE  0.11523    0.03364   3.425
##
## Correlation of Fixed Effects:
##             (Intr)
## Rspns_SbjPE -0.052
```

```
## [1] 15292.05
```

1st and last trial correlations for anxiety and mood

The correlations between first and last anxiety and mood ratings are doubled compared to the previous pilot!
Do we have people who gave less reliable answers? We can see it from the ratings themselves, or predictions
where some people ignored the histograms.

```
## [1] "Correlation between first and last anxiety rating"
```

```
##
##  Pearson's product-moment correlation
##
## data:  final_df10[final_df10$Trial.Number == 1, ]$Response_Ax and final_df10[final_df10$Trial.Number
## t = 3.9135, df = 37, p-value = 0.0003758
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.2719854 0.7316774
## sample estimates:
##     cor
## 0.54107
```

```
## [1] "Correlation between first and last mood rating"
```

```
##
##  Pearson's product-moment correlation
##
## data:  final_df10[final_df10$Trial.Number == 1, ]$Response_H and final_df10[final_df10$Trial.Number
## t = 4.0628, df = 37, p-value = 0.0002423
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.2908819 0.7410709
## sample estimates:
##       cor
## 0.5554232
```

Objective PE and anxiety relationship

We now will run everything again but this time using the objective PE (feedback - histogram_mean) instead of the subjective one (feedback - prediction). The correlation between subjective_PE and anxiety is very similar to objective_PE and anxiety (-0.089 vs -0.087).

```
## [1] "average correlation between Anxiety and PE: -0.0871134288971019"
```
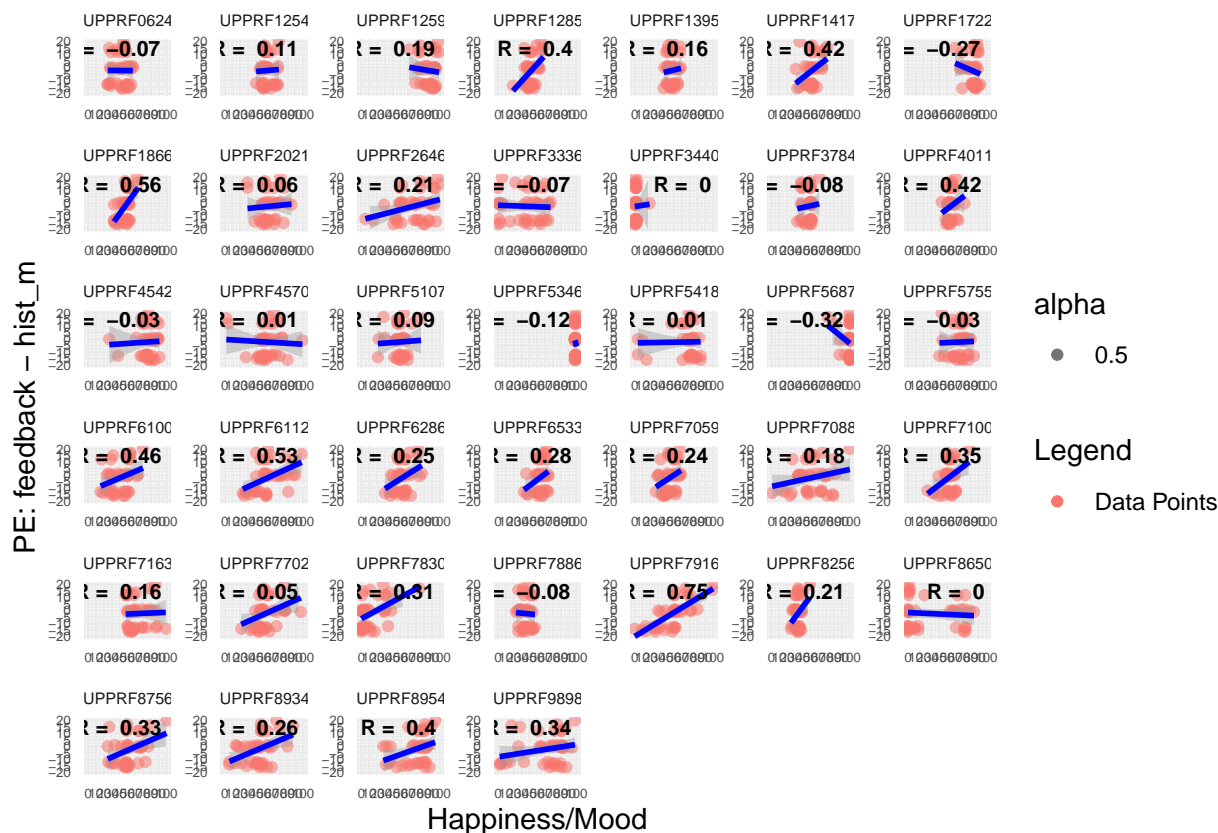
Objective PE and mood relationship

We will repeat the same thing for the relationship between PE and mood. Same as anxiety, the relationship between the objective PE and mood is very similar to the Subj_PE (0.18 vs 0.17).

```
## [1] "average correlation between happiness and objective PE: 0.170645092999263"
```
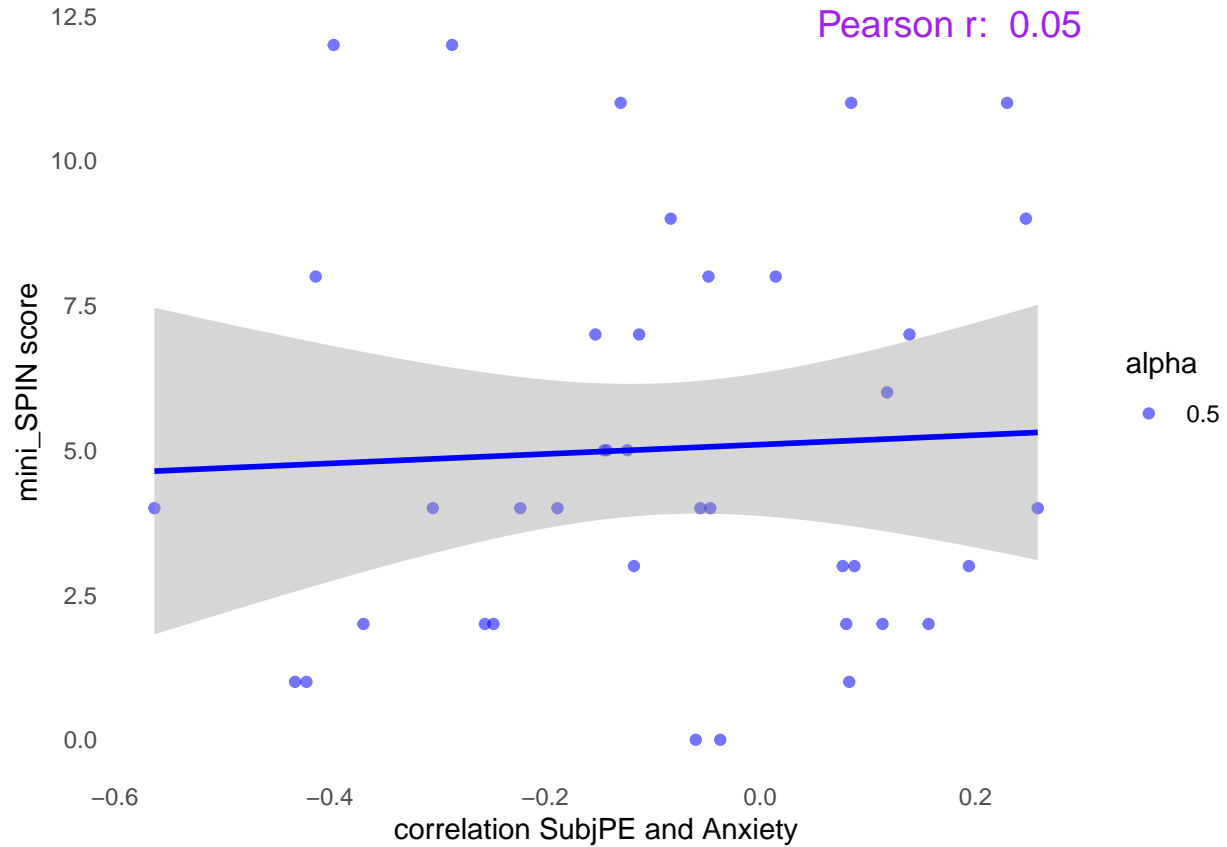
mini-SPIN count

Since these people were not screened for social anxiety, let's see how many of them had social anxiety scores higher than or equal to 6. We have 14/38 people who have high social anxiety on mini-SPIN, compared to 21/38 in the previous pilot.

## [1] "Out of 38 people, these people had a mini_SPIN total score higher or equal to 6: 14"

[1] 0.04964543

Feedback and anxiety relationship

We will now look at the relationship between feedback and anxiety (so without taking prediction or histogram into account). Again, almost the same as the same relationship with Subj_PE and PE. We can again see people who almost always rated 0 or 100 for anxiety.
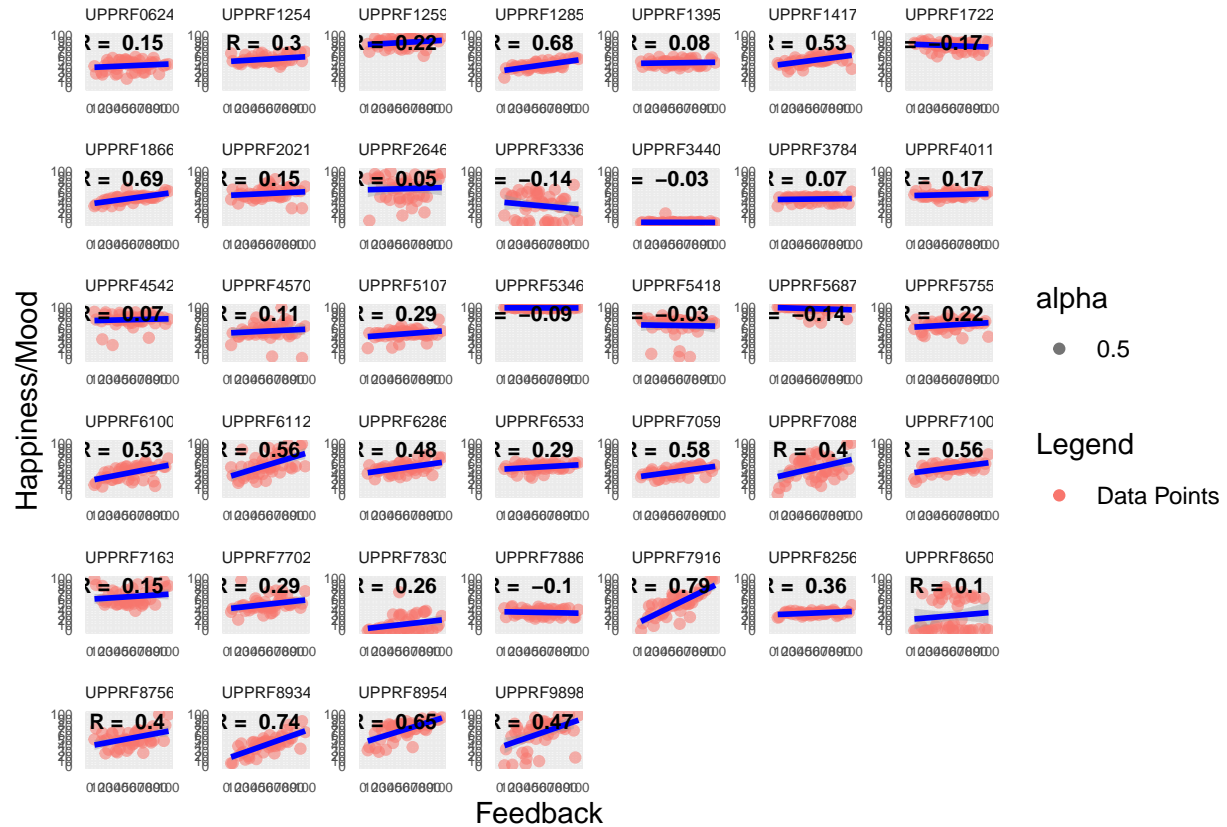
```
## [1] "average correlation between feedback and anxiety: -0.078696284365809"
```
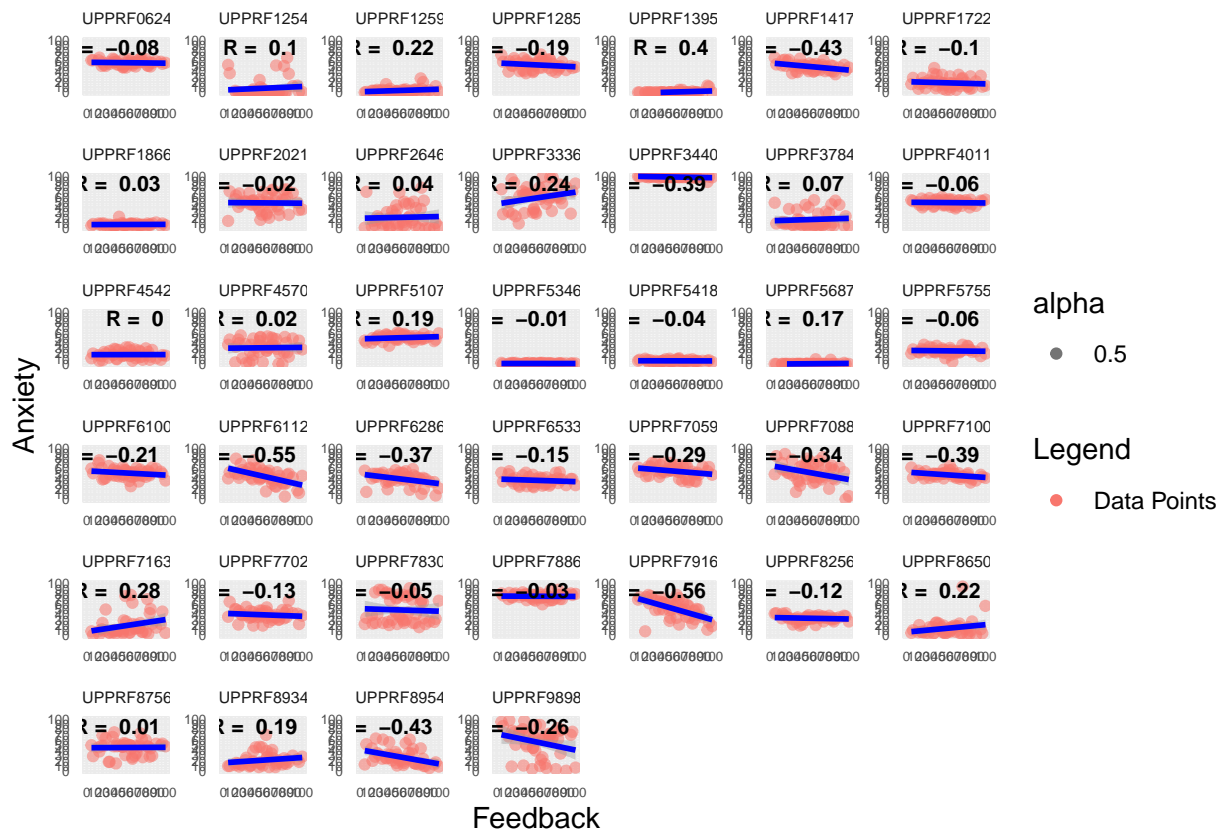
Feedback and mood relationship

The relationship between feedback and happiness: this relationship is stronger than the one with Subj_PE (0.27 vs 0.17).

```
## [1] "average correlation between feedback and happiness: 0.27407792712756"
```

What would be the best next step? We had 14 people with social anxiety, maybe 1) looking these people separately, 2) looking at correlations with mini-SPIN, 3) shall we collect more data? 4) shall we collect data in people with high social anxiety (although we also don't want to use our participants for piloting considering it will be hard to recruit people for the video pilot, we may want to maybe increase the sample to 30/40, so only 15/25 more people to combine with this current pilot data?), 5) would introducing attention shift, or algorithm to produce the feedback change anything, as we do not have any effects of the PE at the moment, it seems?