Ovsanna

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Introduction

Our client, Ovsanna Leyfer, who is from Psychological and Brain Sciences Department, want to develop an intensive (delivered over a course of one week) intervention to deliver CBT for youth aged 11-17 with ANY anxiety disorder to reduce the disability and impairment associated with anxiety disorders. Therefore, She created a multiple baseline study looking at treatment outcomes where eight participants were randomized to 2, 3, or 4 week baseline before starting a one-week treatment, and were asked to answer self-assessment questions every day during the pre-treatment and post-treatment. Our team's goal is to examine the potential indicators of treatment efficacy, as well as to give some statistical insights.

Previous steps

Before making the EDAs, We first changed the variable's names of the .xlsx file to make it easier to import, so the new .xlsx file is different from the original one.

EDAs

According to the data, there are 2 "two-week" patients, 4"three-week" patients and 2 "four-week" patients. We make plots for each patient's each question and the black line seperates the pre-treatment and treatment time.

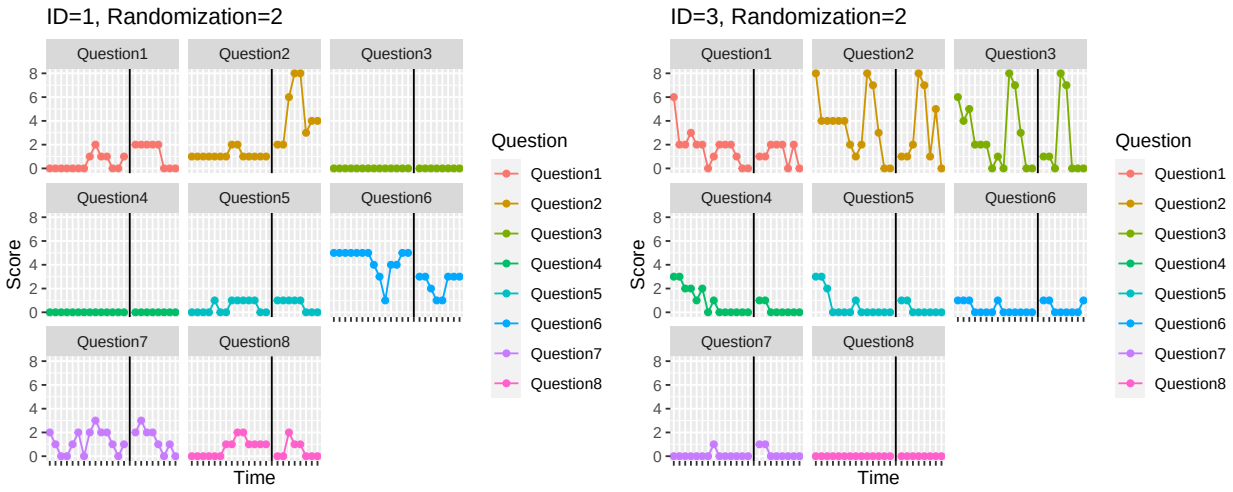


Figure 1: 2-week pre-treatment patients

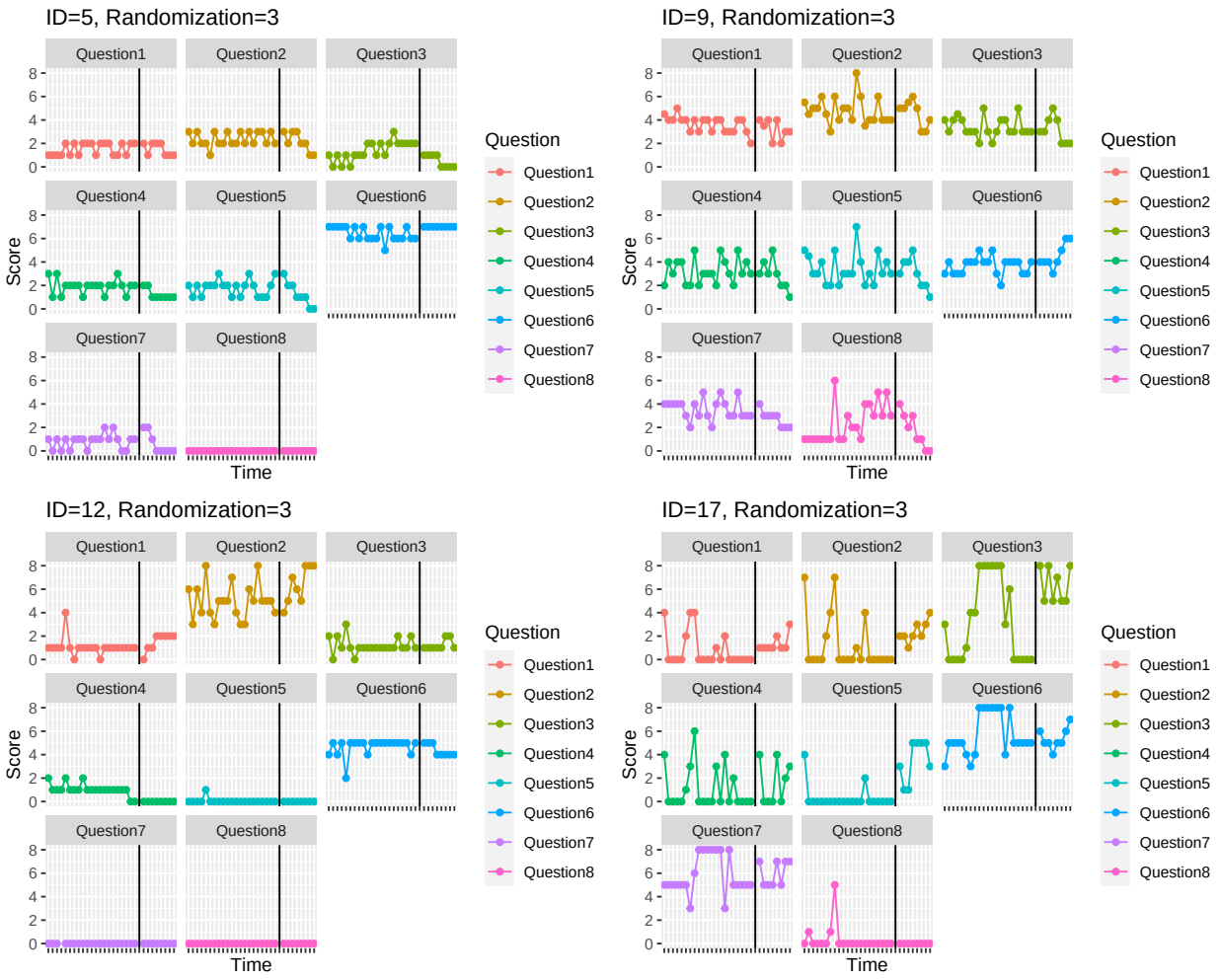


Figure 2: 3-week pre-treatment patients

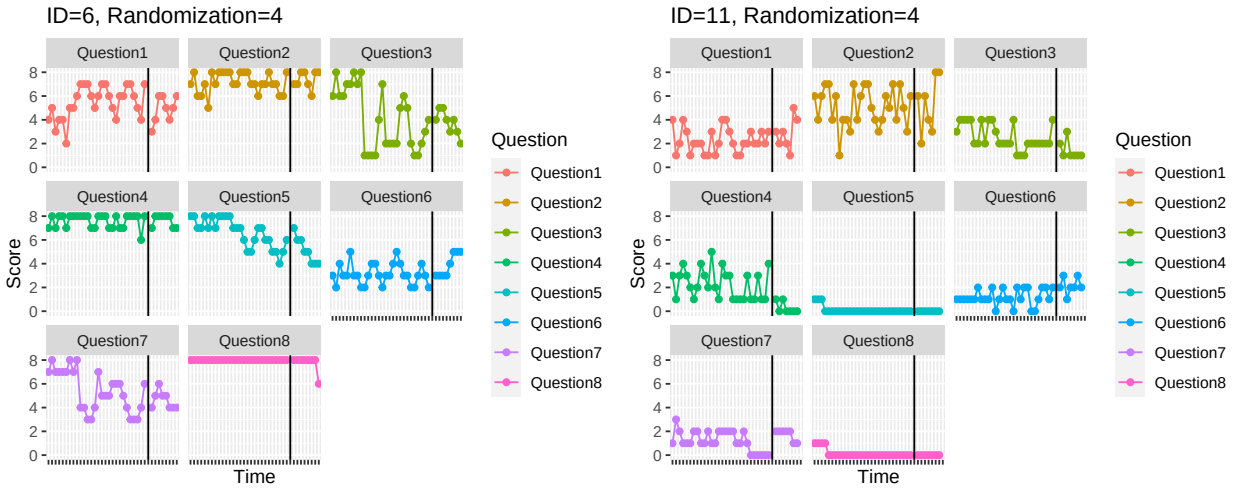


Figure 3: 4-week pre-treatment patients

Comment on these EDAs

After analyzing the plots, several noteworthy observations can be made:

1.The score of Q6, which is"Confident in My Ability to Handle Situations" differs from the other questions. While the scores of other questions increase, the score of Q6 decreases.

2.The treatment appears to be ineffective for many questions. For instance, Q8, which is "Physical Feelings in My Body Scare Me" shows no change in trend for six patients. Moreover, the treatment may even worsen the condition, as seen in the first patient's score of Q2, which is "Max Anxiety Today" increased after treatment.

3.Due to the limited dataset consisting of only eight patients with a scoring scale ranging from 0-8, it is challenging to create effective models and it may not be possible to develop highly accurate models. Nevertheless, efforts can be made to create models despite these limitations.

Methods

By the previous EDA part, we can see the data has some traits.

First, as there are repeated measurements taken for the same individual, there is likely correlation between these measurements. One way to account for this is using a mixed effects model with formula:

$$QuestionScore \sim Treat + Time \times Treat + 1|ID \tag{1}$$

Second, there are measurements collected over time. Auto-regressive models may be appropriate to account for correlation over time.

$$QuestionScore_t = \sum_{i=1}^{p} \varphi_i * QuestionScore_{t-i} + \varepsilon_i \tag{2}$$

Third, the question score y is actually ordinal in nature, ranging from 0 to 8. Thus, we can use ordinal regression to account for this.

$$ordered(QuestionScore) \sim Treat + Time \times Treat + 1|ID \tag{3}$$

Result

We fitted separated model for each problems because different problems may have different effect. Even though the respond is ordinal, a linear model may be a useful starting point for modeling because it is easier to interpret and run diagnostics on. The result of most model is same with what we found in EDA, the score of patient is same after making treatment. For instance, in most problem, only the intercept is significant.

Table 1: Linear Mixed Model for Average Anxiety Today

Row	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	2.136820	0.575868	7.9303	-28.200	0.006 **
Treat	0.197230	0.747232	222.2000	0.264	0.79206
t	-0.001098	0.012335	221.0800	-0.089	0.92916
Treat:t	-0.003483	0.029450	221.4100	-0.118	0.90596

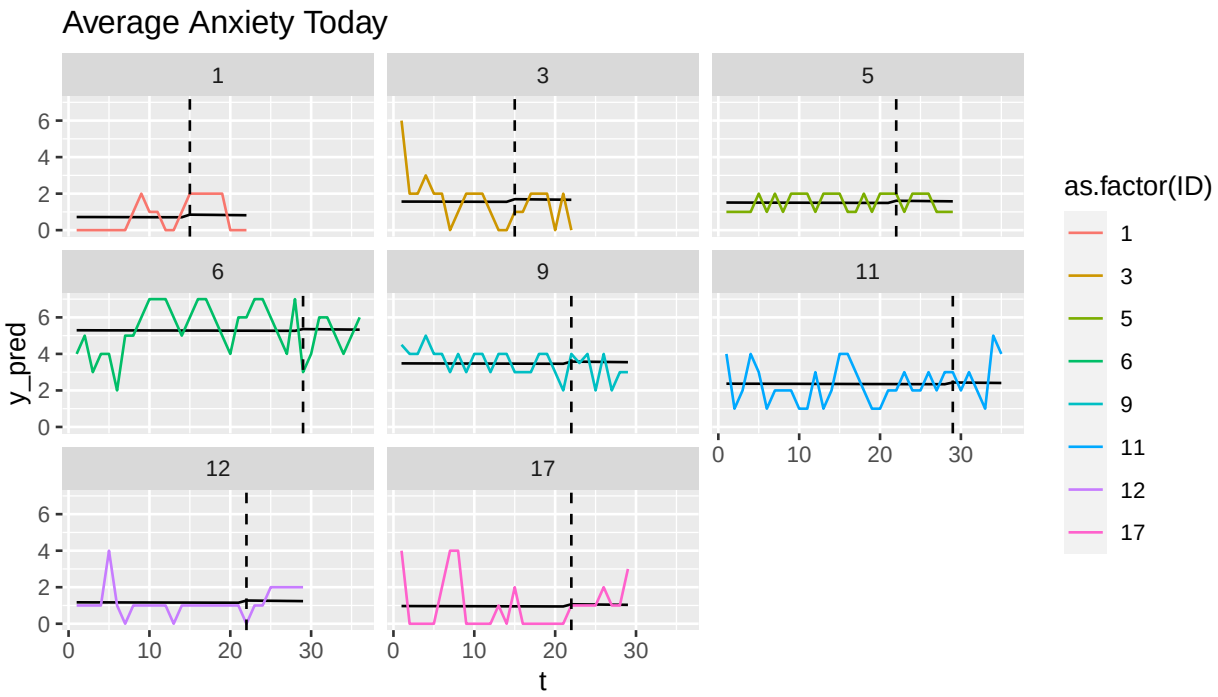


Figure 4: Linear Mixed Model for Average Anxiety Today

We did the auto-correlation analysis because time is variable in our model. From acf plot, there could be temporal effect. Therefore, we tried to use a time series model, namely an autoregressive (AR) mode. The acf plot almost did not change for each problem. Temporal effect may be too small.

There are only two question the treatment seem to effects to patients, Scares Me when I am Nervous and Confident in My Ability to Handle Situations. However,for Scares Me when I am Nervous and Confident, after using AR models, this effect disappeared. From plot of this question, we could not find significant decreasing of score after taking treatment, which are correspond the result of AR model

Table 2: Linear Mixed Model for Scares Me when I am Nervous

Row	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	2.16590	0.81736	7.42557	2.650	0.031243 *
Treat	2.04479	0.72973	221.06774	2.802	0.005527 **
t	-0.04548	0.01204	220.51531	-3.778	0.000203 ***
T:t	-0.05264	0.02874	220.67366	-1.831	0.068379

Table 3: Time Series Model for Scares Me when I am Nervous

Row	Estimate	Std. Error	df	t value	p-value
(Intercept)	2.3685784	0.8454966	220	2.801405	0.005541444**
Treat	1.8656768	1.0657592	220	1.750561	0.081415428
t	-0.0566064	0.0214366	220	-2.640642	0.008867989**
T:t	-0.0463229	0.0451578	220	-1.025802	0.306111548

The result of Confident in My Ability to Handle Situations is much better than result of Scares Me when I am Nervous. The plot also correspond to result of model. Both T and T:t are significant. Form plot and fitted line, we could find some patient increase after treatment. Finally, we also checked with mixed ordinal model because data is ordinal, but compared with mixed ordinal model is hard to visualize. We put the all result in appendix.

Table 4: Linear Mixed Model for Confident in My Ability to Handle Situations

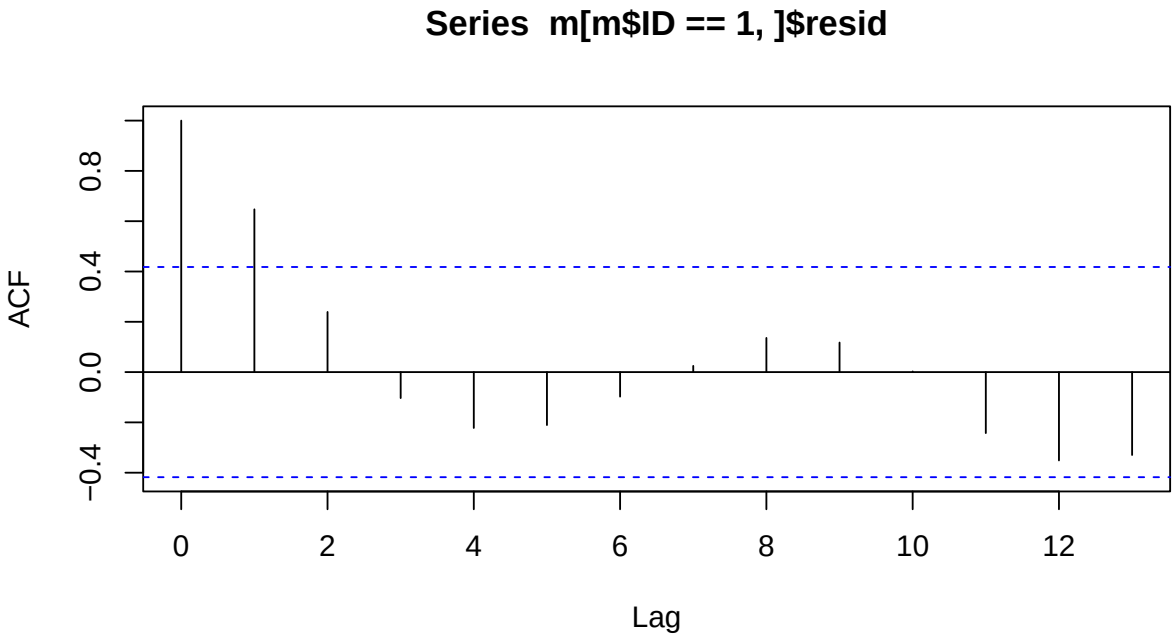


Figure 5: ACF Plot of Linear Mixed Model

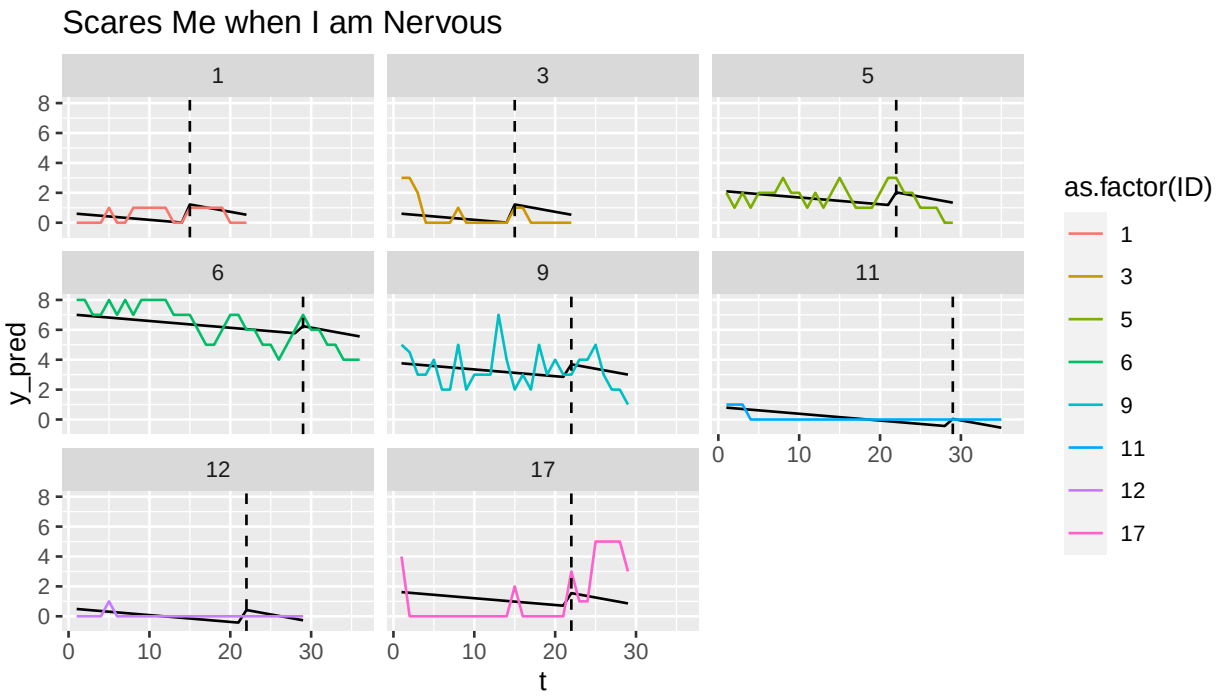


Figure 6: Linear Mixed Model for Scares Me when I am Nervous

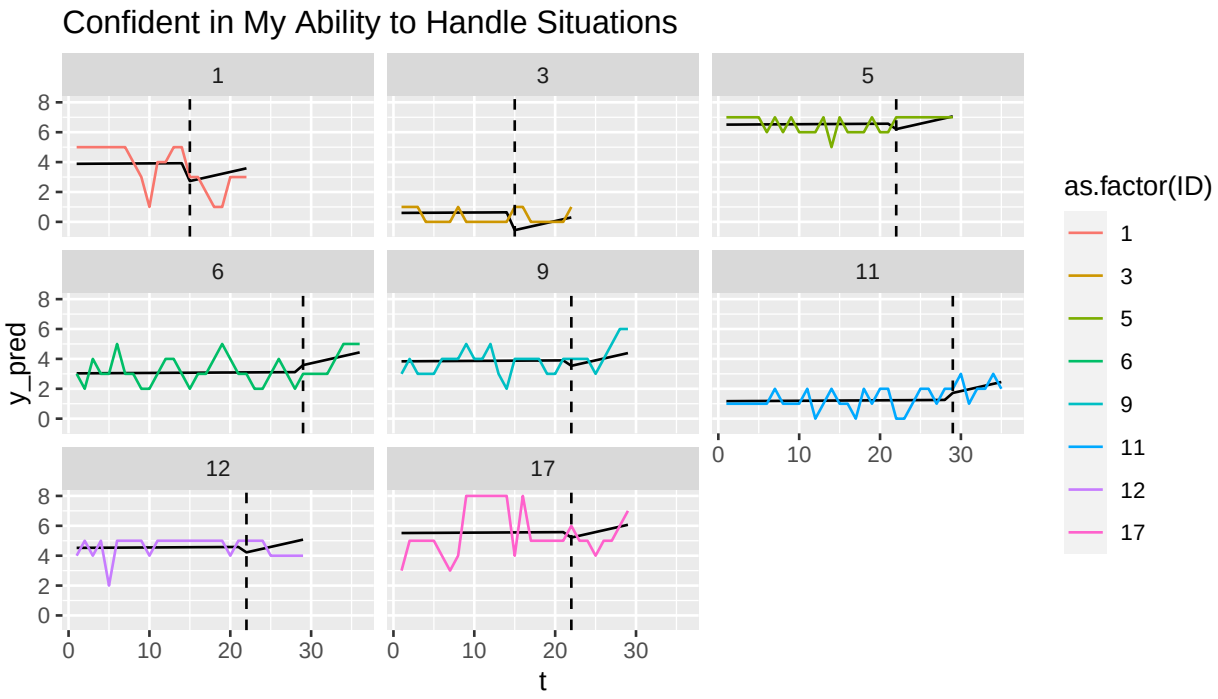


Figure 7: Linear Mixed Model for Confident in My Ability to Handle Situations

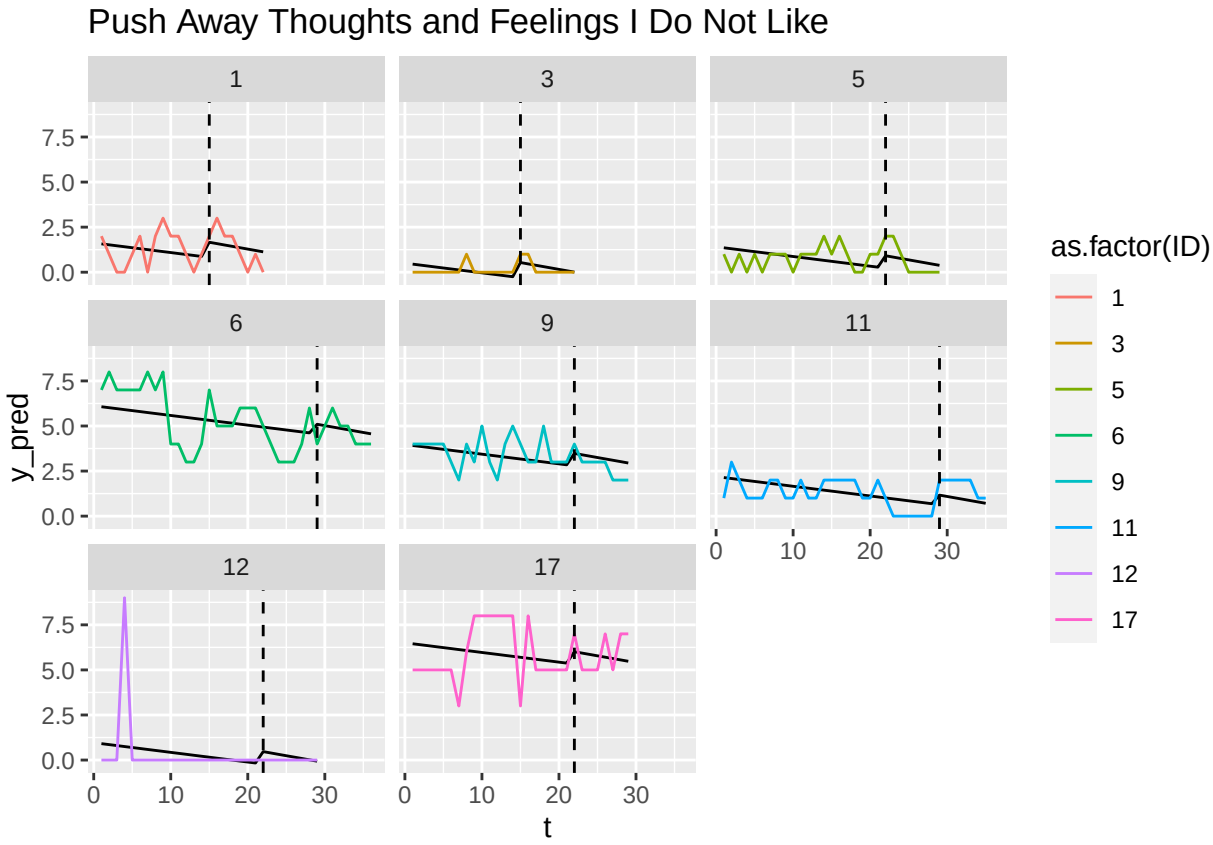
predictors and the outcome may exist. Additionally, the mixed effects model assumes that the effects of the predictors are constant across all individuals, which may not be the case in reality. Furthermore, the number of participants in this study is relatively small, which may limit the power of the mixed effects model to detect significant treatment effects.

Another limitation of the auto-regressive models is that they assume that the correlation between observations decays exponentially over time. This assumption may not hold in all cases, and the correlation may decay at a different rate than the exponential decay assumed by the model. Moreover, the auto-regressive models may be sensitive to outliers and may not perform well in the presence of non-stationarity or non-linear relationships.

Finally, the ordinal regression model assumes a proportional odds assumption, which means that the odds of being in a higher category of the outcome variable are proportional across all levels of the predictors. While there are ways to check this assumption, such as the Brant test, violating the assumption may lead to biased parameter estimates and inaccurate conclusions.

Appendix

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: y ~ Treat + t * Treat + (1 | as.factor(ID))
##    Data: m6
##
## REML criterion at convergence: 760.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.7610 -0.5608 -0.1045  0.4846  7.2786
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 5.532    2.352
##  Residual                  1.285    1.134
## Number of obs: 231, groups:  as.factor(ID), 8
##
## Fixed effects:
##              Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)   2.91240    0.84920   7.47426   3.430  0.00994 **
## Treat         1.17029    0.80633 221.19792   1.451  0.14809
## t            -0.05375    0.01330 220.57485  -4.041 7.37e-05 ***
## Treat:t      -0.02202    0.03176 220.75374  -0.693  0.48878
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr) Treat  t
## Treat   -0.027
## t       -0.173  0.021
## Treat:t  0.056 -0.950 -0.258
```



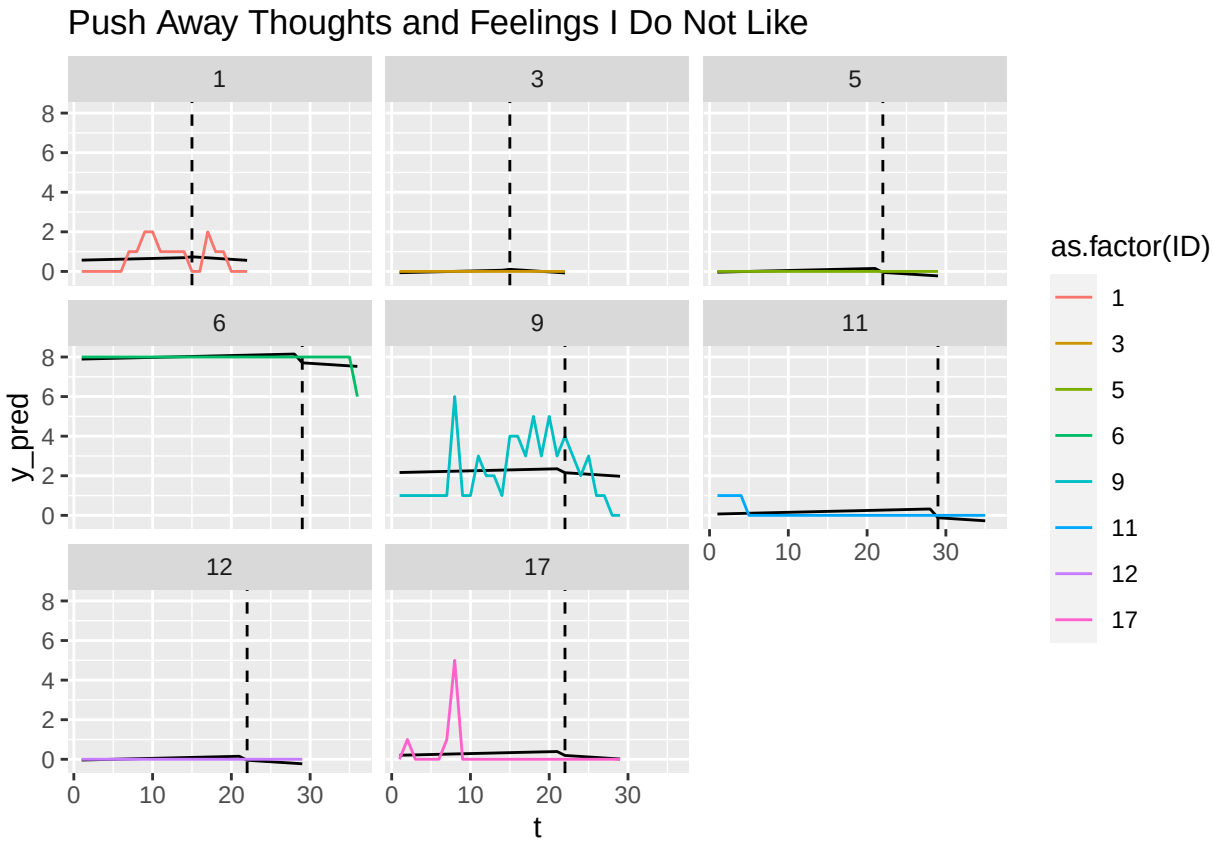

```
## Linear mixed-effects model fit by REML
##   Data: m6
##        AIC      BIC    logLik
##   750.9272 774.9019 -368.4636
##
## Random effects:
##  Formula: ~1 | as.factor(ID)
##         (Intercept) Residual
## StdDev:    2.351128 1.155872
##
## Correlation Structure: AR(1)
##  Formula: ~1 | as.factor(ID)
##  Parameter estimate(s):
##       Phi
## 0.3271351
## Fixed effects:  y ~ Treat + t * Treat
##                 Value Std.Error  DF   t-value p-value
## (Intercept)  2.8771326 0.8633003 220  3.332713  0.0010
## Treat        1.3259463 1.0232815 220  1.295779  0.1964
## t           -0.0516173 0.0175745 220 -2.937062  0.0037
## Treat:t     -0.0288226 0.0410666 220 -0.701851  0.4835
##  Correlation:
##         (Intr) Treat  t
## Treat   -0.044
## t       -0.228  0.083
## Treat:t  0.079 -0.951 -0.308
```

```
##
## Standardized Within-Group Residuals:
##        Min         Q1        Med         Q3        Max
## -2.6735718 -0.5284025 -0.1054118  0.4539406  7.1520062
##
## Number of Observations: 231
## Number of Groups: 8

## Cumulative Link Mixed Model fitted with the Laplace approximation
##
## formula: y ~ Treat + t * Treat + (1 | as.factor(ID))
## data:    m6
##
##  link  threshold nobs logLik  AIC    niter      max.grad cond.H
##  logit flexible  231  -289.61 605.22 1085(7898) 1.29e-03 2.9e+05
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 21.71    4.66
## Number of groups:  as.factor(ID) 8
##
## Coefficients:
##         Estimate Std. Error z value Pr(>|z|)
## Treat    2.84198    1.42529   1.994  0.04615 *
## t       -0.08166    0.02327  -3.509  0.00045 ***
## Treat:t -0.06905    0.05422  -1.273  0.20285
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##     Estimate Std. Error z value
## 0|1  -3.6579     1.6718  -2.188
## 1|2  -1.8403     1.6657  -1.105
## 2|3   0.7256     1.6768   0.433
## 3|4   2.8651     1.6913   1.694
## 4|5   4.1530     1.6984   2.445
## 5|6   5.7648     1.7102   3.371
## 6|7   6.1799     1.7132   3.607
## 7|8   7.1735     1.7265   4.155
## 8|9   9.7671     1.9727   4.951

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: y ~ Treat + t * Treat + (1 | as.factor(ID))
##    Data: m7
##
## REML criterion at convergence: 556.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.8165 -0.2910 -0.0668  0.1268  6.6611
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
```

```
##  as.factor(ID) (Intercept) 7.5792   2.7530
##  Residual                  0.5043   0.7102
## Number of obs: 231, groups:  as.factor(ID), 8
##
## Fixed effects:
##               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)   1.336496   0.979308   7.140944   1.365   0.2138
## Treat         0.561208   0.505673 220.362513   1.110   0.2683
## t             0.009391   0.008337 220.174137   1.126   0.2613
## Treat:t      -0.034975   0.019912 220.227741  -1.757   0.0804 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr) Treat  t
## Treat   -0.015
## t       -0.094  0.020
## Treat:t  0.030 -0.950 -0.257
```



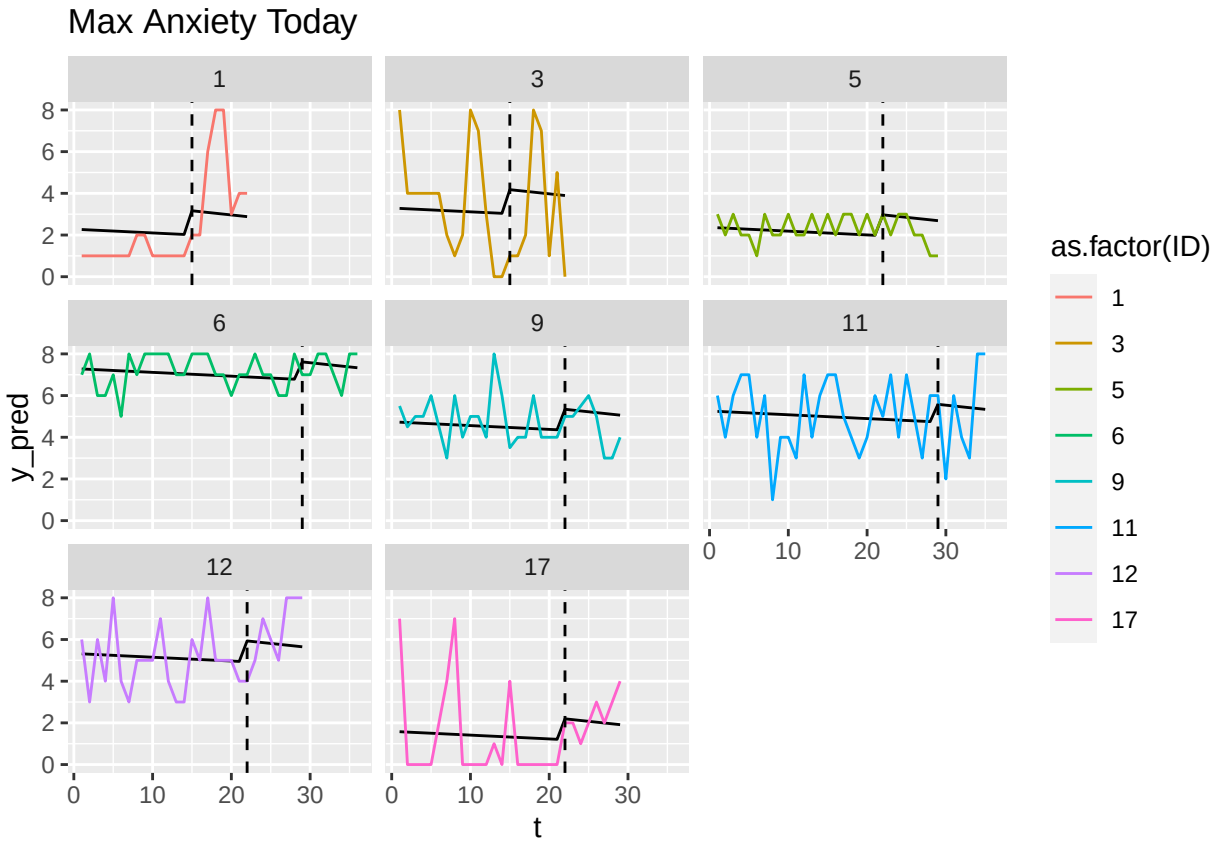

```
## Linear mixed-effects model fit by REML
##   Data: m7
##        AIC      BIC    logLik
##   543.8212 567.7959 -264.9106
##
## Random effects:
##  Formula: ~1 | as.factor(ID)
```

```
##         (Intercept)  Residual
## StdDev:    2.745514 0.7291276
##
## Correlation Structure: AR(1)
##  Formula: ~1 | as.factor(ID)
##  Parameter estimate(s):
##       Phi
## 0.3603219
## Fixed effects:  y ~ Treat + t * Treat
##                  Value Std.Error  DF   t-value p-value
## (Intercept)  1.3543270 0.9824060 220  1.378582  0.1694
## Treat        0.6377633 0.6572827 220  0.970303  0.3330
## t            0.0068061 0.0113633 220  0.598956  0.5498
## Treat:t     -0.0364790 0.0264524 220 -1.379041  0.1693
##  Correlation:
##         (Intr) Treat  t
## Treat   -0.026
## t       -0.130  0.092
## Treat:t  0.045 -0.951 -0.313
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -2.64643410 -0.30198290 -0.05895287  0.11544185  6.47916091
##
## Number of Observations: 231
## Number of Groups: 8

## Cumulative Link Mixed Model fitted with the Laplace approximation
##
## formula: y ~ Treat + t * Treat + (1 | as.factor(ID))
## data:    m7
##
##  link  threshold nobs logLik  AIC    niter       max.grad cond.H
##  logit flexible  231  -117.22 256.43 1128(12026) 1.12e+02 1.2e+07
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 65.07    8.067
## Number of groups:  as.factor(ID) 8
##
## Coefficients:
##           Estimate Std. Error z value Pr(>|z|)
## Treat    5.3052169  0.0006685 7935.49   <2e-16 ***
## t        0.0080511  0.0006694   12.03   <2e-16 ***
## Treat:t -0.2772134  0.0006686 -414.61   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##      Estimate Std. Error z value
## 0|1 2.863e+00  6.686e-04 4282.21
## 1|2 5.151e+00  4.280e-01   12.04
## 2|3 5.811e+00  4.794e-01   12.12
## 3|4 6.704e+00  5.624e-01   11.92
```

```
## 4|5 7.363e+00  6.512e-01   11.31
## 5|6 8.637e+00  9.682e-01    8.92
## 6|8 1.113e+01  2.213e+00    5.03
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: y ~ Treat + t * Treat + (1 | as.factor(ID))
##    Data: m1
##
## REML criterion at convergence: 925.7
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.4789 -0.6876 -0.0800  0.5115  3.3440
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 3.912    1.978
##  Residual                  2.756    1.660
## Number of obs: 231, groups:  as.factor(ID), 8
##
## Fixed effects:
##              Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)   4.02130    0.74339   8.44541   5.409 0.000532 ***
## Treat         1.48380    1.17753 223.22366   1.260 0.208951
## t            -0.01821    0.01945 221.62260  -0.936 0.350308
## Treat:t      -0.02194    0.04643 222.09728  -0.473 0.636988
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr) Treat  t
## Treat   -0.046
## t       -0.289  0.025
## Treat:t  0.095 -0.950 -0.262
```




```
## Linear mixed-effects model fit by REML
##   Data: m1
##        AIC      BIC   logLik
##   920.3059 944.2806 -453.153
##
## Random effects:
##  Formula: ~1 | as.factor(ID)
##         (Intercept) Residual
## StdDev:      1.9288 1.705292
##
## Correlation Structure: AR(1)
##  Formula: ~1 | as.factor(ID)
##  Parameter estimate(s):
##       Phi
## 0.3228426
## Fixed effects:  y ~ Treat + t * Treat
##                 Value Std.Error  DF   t-value p-value
## (Intercept)  4.096115 0.7630646 220  5.367980  0.0000
## Treat        0.931428 1.4995962 220  0.621119  0.5352
## t           -0.020236 0.0257955 220 -0.784460  0.4336
## Treat:t     -0.001454 0.0602599 220 -0.024126  0.9808
##  Correlation:
##         (Intr) Treat  t
## Treat   -0.075
## t       -0.379  0.088
## Treat:t  0.133 -0.951 -0.313
```

```
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -2.42294175 -0.69885558 -0.09197737  0.49122749  3.13779198
##
## Number of Observations: 231
## Number of Groups: 8
```

```
## Warning in update.uC(rho): Non finite negative log-likelihood
##   at iteration 350
```

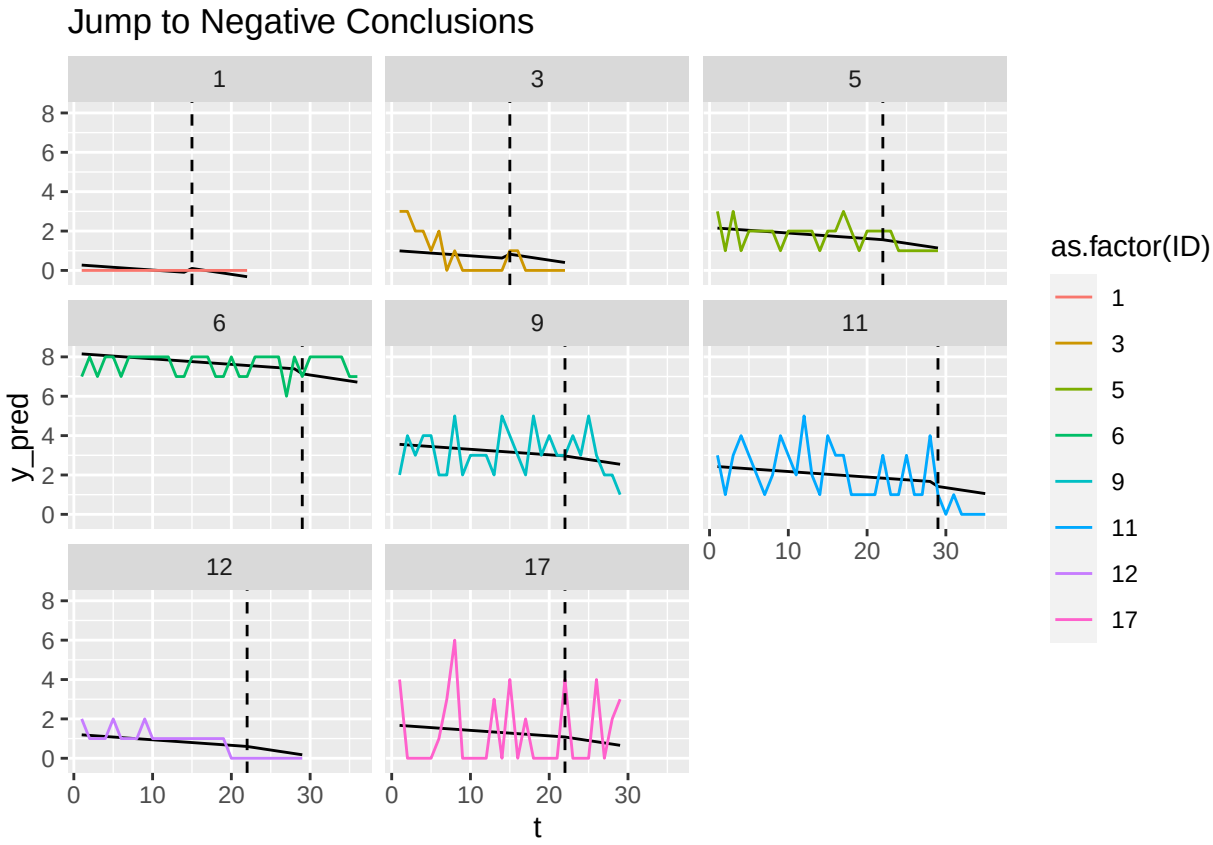
```
## Warning in update.uC(rho): Non finite negative log-likelihood
##   at iteration 618
```

```
## Warning in update.uC(rho): Non finite negative log-likelihood
##   at iteration 758
```

```
## Warning in update.uC(rho): Non finite negative log-likelihood
##   at iteration 1471
```

```
## Cumulative Link Mixed Model fitted with the Laplace approximation
##
## formula: ordered(y) ~ Treat + t * Treat + (1 | as.factor(ID))
## data:    m1
##
##  link  threshold nobs logLik  AIC    niter      max.grad cond.H
##  logit flexible  231  -439.51 909.03 1588(9505) 1.79e-04 9.1e+04
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 4.534    2.129
## Number of groups:  as.factor(ID) 8
##
## Coefficients:
##          Estimate Std. Error z value Pr(>|z|)
## Treat    1.230838   1.457687   0.844    0.398
## t       -0.017650   0.020088  -0.879    0.380
## Treat:t -0.004956   0.057092  -0.087    0.931
##
## Threshold coefficients:
##       Estimate Std. Error z value
## 0|1    -3.6952     0.8575  -4.309
## 1|2    -2.3857     0.8302  -2.874
## 2|3    -1.2853     0.8216  -1.564
## 3|3.5  -0.2761     0.8175  -0.338
## 3.5|4  -0.2409     0.8174  -0.295
## 4|4.5   0.8387     0.8180   1.025
## 4.5|5   0.9052     0.8182   1.106
## 5|5.5   1.5909     0.8213   1.937
## 5.5|6   1.6572     0.8216   2.017
## 6|7     2.4975     0.8293   3.011
## 7|8     3.6631     0.8485   4.317
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: y ~ Treat + t * Treat + (1 | as.factor(ID))
##    Data: m3
##
## REML criterion at convergence: 709.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.6271 -0.6634 -0.0498  0.3780  4.4834
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 6.153    2.481
##  Residual                  1.019    1.009
## Number of obs: 231, groups:  as.factor(ID), 8
##
## Fixed effects:
##              Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)   2.57940    0.89034   7.33575   2.897   0.0219 *
## Treat         0.70662    0.71833 220.86647   0.984   0.3263
## t            -0.02803    0.01185 220.41221  -2.366   0.0189 *
## Treat:t      -0.03221    0.02829 220.54215  -1.139   0.2561
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr) Treat  t
## Treat   -0.023
## t       -0.147  0.020
## Treat:t  0.048 -0.950 -0.258
```




```
##                   Value  Std.Error  DF    t-value     p-value
## (Intercept)  2.58344986 0.89225260 220  2.8954243 0.004168142
## Treat        0.76273737 0.77339309 220  0.9862221 0.325107520
## t           -0.02825279 0.01284489 220 -2.1995349 0.028881183
## Treat:t     -0.03430151 0.03055475 220 -1.1226242 0.262820803
```

```
## Cumulative Link Mixed Model fitted with the Laplace approximation
##
## formula: ordered(y) ~ Treat + t * Treat + (1 | as.factor(ID))
## data:    m3
##
##  link  threshold nobs logLik  AIC    niter       max.grad cond.H
##  logit flexible  231  -288.62 601.23 1089(11331) 1.06e-04 3.0e+05
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 25.07    5.007
## Number of groups:  as.factor(ID) 8
##
## Coefficients:
##         Estimate Std. Error z value Pr(>|z|)
## Treat    0.98291    1.63590   0.601   0.5479
## t       -0.05472    0.02322  -2.357   0.0184 *
## Treat:t -0.05465    0.06253  -0.874   0.3821
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##     Estimate Std. Error z value
## 0|1  -2.7378     1.8524  -1.478
## 1|2  -1.0018     1.8465  -0.543
## 2|3   0.3107     1.8461   0.168
## 3|4   1.6044     1.8525   0.866
## 4|5   3.0195     1.8769   1.609
## 5|6   4.5991     1.9919   2.309
## 6|7   6.3342     2.3704   2.672
## 7|8   9.1337     2.5087   3.641

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: y ~ Treat + t * Treat + (1 | as.factor(ID))
##    Data: m2
##
## REML criterion at convergence: 969.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.46862 -0.46695 -0.08721  0.50280  3.04935
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 2.403    1.550
##  Residual                  3.412    1.847
## Number of obs: 231, groups:  as.factor(ID), 8
##
## Fixed effects:
##              Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)   2.96285    0.61566   9.86430   4.812 0.000738 ***
## Treat         1.05237    1.30502 225.35824   0.806 0.420863
## t            -0.05534    0.02161 222.91949  -2.561 0.011094 *
## Treat:t      -0.01090    0.05154 223.69761  -0.211 0.832764
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr) Treat  t
## Treat   -0.063
## t       -0.389  0.030
## Treat:t  0.128 -0.950 -0.267
```


```
## Warning in update.uC(rho): Non finite negative log-likelihood
##   at iteration 822

## Cumulative Link Mixed Model fitted with the Laplace approximation
##
## formula: ordered(y) ~ Treat + t * Treat + (1 | as.factor(ID))
## data:    m2
##
##  link  threshold nobs logLik  AIC    niter      max.grad cond.H
##  logit flexible  231  -404.26 834.53 1189(5966) 7.16e-05 7.4e+04
##
## Random effects:
##  Groups        Name        Variance Std.Dev.
##  as.factor(ID) (Intercept) 5.559    2.358
## Number of groups:  as.factor(ID) 8
##
## Coefficients:
##          Estimate Std. Error z value Pr(>|z|)
## Treat    0.585447   1.488199   0.393   0.6940
## t       -0.043191   0.020933  -2.063   0.0391 *
## Treat:t -0.007855   0.055678  -0.141   0.8878
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
```

```
##       Estimate Std. Error z value
## 0|1    -2.1710     0.7514  -2.889
## 1|2    -0.5730     0.7539  -0.760
## 2|3     0.6361     0.7566   0.841
## 3|4     1.3162     0.7586   1.735
## 4|4.5   2.0933     0.7650   2.736
## 4.5|5   2.1310     0.7655   2.784
## 5|6     2.6462     0.7735   3.421
## 6|7     2.9689     0.7804   3.804
## 7|8     3.4512     0.7962   4.334
```