# Wheel for assessing spinal block study

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## Contents



## List of Tables

## List of Figures

# 1 Preliminary Summary

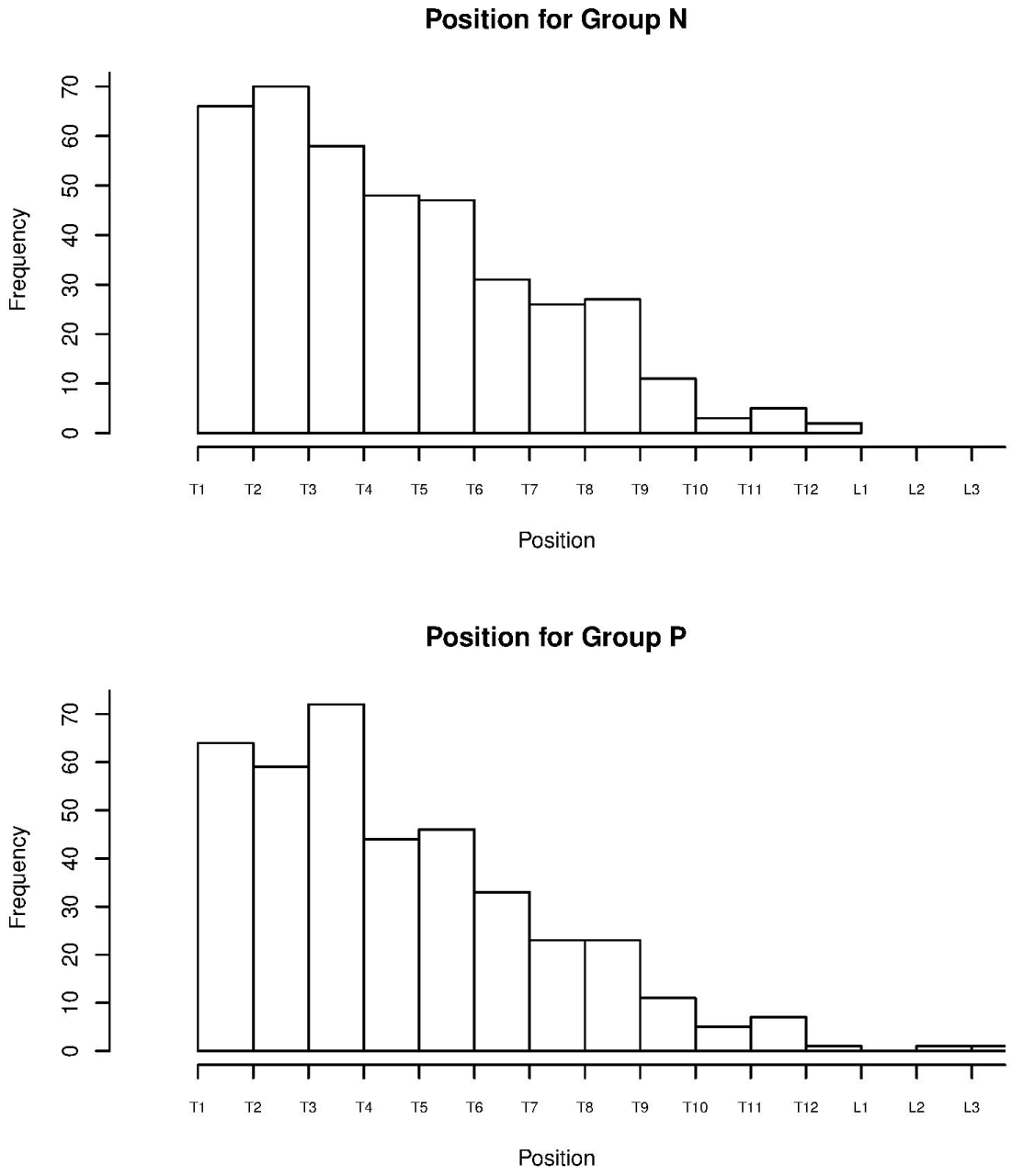


Figure 1: Distribution of Block Position for Group N and P, respectively

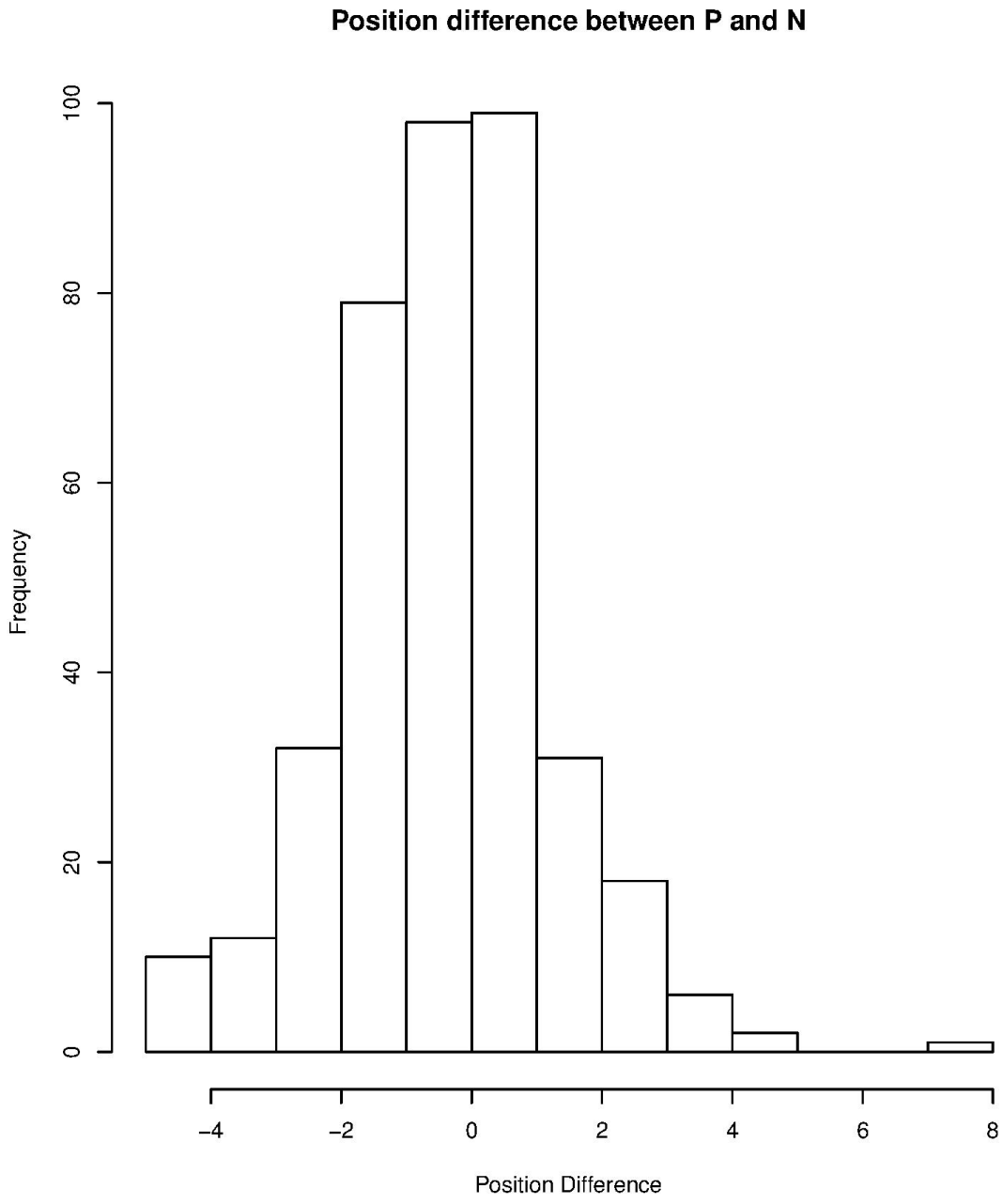


Figure 2: Distribution of Block Position Difference between Group N and P

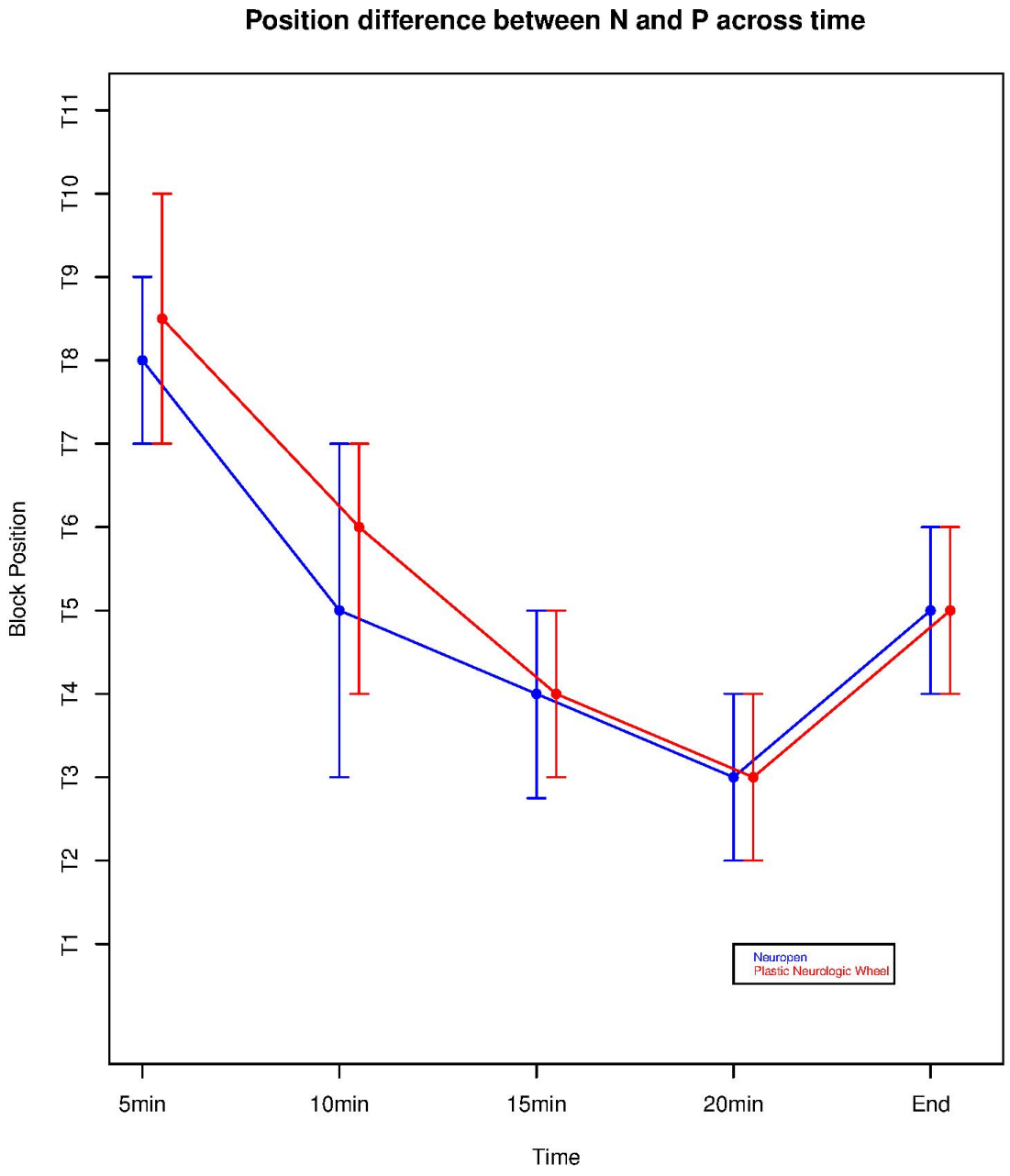


Figure 3: Position Difference between N and P across Time

*Red/blue dots represent median of block position for Group N/P, error bars represent corresponding 25th and 75th pecentile at that specific time.

# 2 Fix effect examination, Ho: miu(N) = miu(P)

## 2.1 Nonparametric Hypothesis Test

Table 1a, 1b: Non parametric test to test the mean difference of block position between group N and group P

```
        Wilcoxon rank sum test with continuity correction

data:  datlongnew$Positioncon by datlongnew$NP
W = 75974.5, p-value = 0.7858
alternative hypothesis: true location shift is not equal to 0
```

```
        Kruskal-Wallis rank sum test

data:  datlongnew$Positioncon by datlongnew$NP
Kruskal-Wallis chi-squared = 0.074, df = 1, p-value = 0.7856
```

## 2.2 Regression Analysis

Table 2a: Mixed effect model, include subject as random effect

```
Linear mixed model fit by REML
Formula: Positioncon ~ NP + observer + Time + LeftRight + (1 | Subject)
   Data: datlongnew
  AIC  BIC logLik deviance REMLdev
 2967 3019  -1473     2927    2945
Random effects:
 Groups   Name        Variance Std.Dev.
 Subject  (Intercept) 1.6090   1.2685
 Residual             2.2348   1.4949
Number of obs: 776, groups: Subject, 41

Fixed effects:
             Estimate Std. Error t value
(Intercept)  8.3153295  0.2744715   30.30
NPP          0.0632845  0.1088727    0.58
observerJWD  0.1290331  0.1865208    0.69
observerJW  -0.3514178  0.1566818   -2.24
Time10min   -2.8458262  0.1684355  -16.90
Time15min   -4.4426707  0.1698118  -26.16
Time20min   -5.4648015  0.1725812  -31.67
TimeEnd     -3.2725050  0.1717770  -19.05
LeftRightR   0.0006285  0.1073355    0.01

Correlation of Fixed Effects:
            (Intr) NPP    obsJWD obsrJW Tm10mn Tm15mn Tm20mn TimEnd
NPP         -0.240
observerJWD -0.409  0.051
observerJW  -0.425  0.128  0.671
Time10min   -0.315 -0.009  0.006  0.000
Time15min   -0.313 -0.009  0.007  0.000  0.510
Time20min   -0.308 -0.009  0.008  0.001  0.502  0.502
TimeEnd     -0.308 -0.009  0.007  0.000  0.504  0.500  0.492
LeftRightR  -0.196  0.000  0.000  0.002  0.000  0.000  0.000  0.000
```

Table 2b: Regression Analysis:Mixed effect model including subject as random effect, considering interaction between Tools (N/P) and observers

```
Linear mixed model fit by REML
Formula: Positioncon ~ NP * observer + Time + LeftRight + (1 | Subject)
   Data: datlongnew
  AIC  BIC logLik deviance REMLdev
 2968 3029  -1471     2925    2942
Random effects:
 Groups   Name        Variance Std.Dev.
 Subject  (Intercept) 1.5502   1.2451
 Residual             2.2386   1.4962
Number of obs: 776, groups: Subject, 41

Fixed effects:
                   Estimate Std. Error t value
(Intercept)       8.3417545  0.3280461   25.43
NPP               0.0713140  0.3578155    0.20
observerJWD      -0.1503348  0.3064368   -0.49
observerJW       -0.2442899  0.3259607   -0.75
Time10min        -2.8459453  0.1685796  -16.88
Time15min        -4.4420894  0.1699560  -26.14
Time20min        -5.4640860  0.1727258  -31.63
TimeEnd          -3.2725176  0.1719209  -19.04
LeftRightR        0.0007876  0.1074273    0.01
NPP:observerJWD   0.4199850  0.4337784    0.97
NPP:observerJW   -0.3413593  0.5880484   -0.58

Correlation of Fixed Effects:
            (Intr) NPP    obsJWD obsrJW Tm10mn Tm15mn Tm20mn TimEnd LftRgR
NPP         -0.591
observerJWD -0.520  0.477
observerJW  -0.631  0.829  0.482
```

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time10min | −0.265 | 0.000 | 0.006 | 0.002 | | | | | |
| Time15min | −0.264 | 0.001 | 0.006 | 0.003 | 0.510 | | | | |
| Time20min | −0.260 | 0.001 | 0.006 | 0.003 | 0.502 | 0.502 | | | |
| TimeEnd | −0.259 | −0.001 | 0.004 | 0.002 | 0.504 | 0.500 | 0.492 | | |
| LeftRightR | −0.163 | −0.002 | −0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| NPP:bsrvJWD | 0.454 | −0.707 | −0.782 | −0.489 | −0.003 | −0.002 | −0.003 | −0.001 | 0.002 |
| NPP:bsrvrJW | 0.491 | −0.881 | −0.217 | −0.868 | −0.003 | −0.004 | −0.003 | −0.002 | 0.002 |

| | NPP:JWD |
|---|---|
| NPP | |
| observerJWD | |
| observerJW | |
| Time10min | |
| Time15min | |
| Time20min | |
| TimeEnd | |
| LeftRightR | |
| NPP:bsrvJWD | |
| NPP:bsrvrJW | 0.432 |

Table 2c: Anova test indicate no benefit for adding the interaction term, so we choose the first model

```
Data: datlongnew
Models:
mod1: Positioncon ~ NP + observer + Time + LeftRight + (1 | Subject)
mod1blah: Positioncon ~ NP * observer + Time + LeftRight + (1 | Subject)
         Df    AIC    BIC  logLik  Chisq Chi Df Pr(>Chisq)
mod1     11 2948.7 2999.9 -1463.4
mod1blah 13 2950.6 3011.1 -1462.3 2.1873      2      0.335
```

Table 2d: MCMC sampling calculate p value for both summary mod1 and anova mod1

```
$fixed
            Estimate MCMCmean HPD95lower HPD95upper pMCMC Pr(>|t|)
(Intercept)   8.3153   8.3425     7.8668     8.8025 0.001   0.0000
NPP           0.0633   0.0650    -0.1440     0.2790 0.550   0.5612
observerJWD   0.1290   0.0892    -0.2536     0.4550 0.622   0.4893
observerJW   -0.3514  -0.3687    -0.6455    -0.0137 0.022   0.0252
Time10min    -2.8458  -2.8506    -3.2245    -2.5489 0.001   0.0000
Time15min    -4.4427  -4.4434    -4.7825    -4.1109 0.001   0.0000
Time20min    -5.4648  -5.4575    -5.7989    -5.1224 0.001   0.0000
TimeEnd      -3.2725  -3.2847    -3.6487    -2.9369 0.001   0.0000
LeftRightR    0.0006  -0.0052    -0.2122     0.2110 0.946   0.9953

$random
    Groups        Name Std.Dev. MCMCmedian MCMCmean HPD95lower HPD95upper
1  Subject (Intercept)   1.2685     0.9548    0.9593     0.7689     1.1522
2 Residual               1.4949     1.5264    1.5251     1.4402     1.6018
```

| | Df | Sum Sq | Mean Sq | F value | upper.den.df | upper.p.val | lower.den.df |
|---|---|---|---|---|---|---|---|
| NP | 1 | 1.0434 | 1.0434 | 0.4669 | 767 | 0.4946 | 726 |
| observer | 2 | 35.6788 | 17.8394 | 7.9827 | 767 | 0.0004 | 726 |
| Time | 4 | 2579.5917 | 644.8979 | 288.5768 | 767 | 0.0000 | 726 |
| LeftRight | 1 | 0.0001 | 0.0001 | 0.0000 | 767 | 0.9953 | 726 |

| | lower.p.val | expl.dev.(%) |
|---|---|---|
| NP | 0.4946 | 0.0196 |
| observer | 0.0004 | 0.6716 |
| Time | 0.0000 | 48.5605 |
| LeftRight | 0.9953 | 0.0000 |

Table 3: Observer distribution of Group N and P, observer TC was not included for regression analysis since he/she only observed one subject

```
table(datlongnew$N)
 CB  JW JWD  TC
  8  20  12   1
```

```
table(datlongnew$P)
 CB  JW JWD
 11  15  15
```

# 3 Random Effect Examination, Ho: sigma(N-observer)=sigma(P-observer)

Table 4a: Model3: Random intercept model, include both observers and subjects as independent random effect

```
Linear mixed model fit by REML
Formula: Positioncon ~ NP + (1 | observer) + (1 | Subject)
   Data: datlongnew
  AIC  BIC logLik deviance REMLdev
 3638 3661  -1814     3625    3628
Random effects:
 Groups   Name        Variance Std.Dev.
 Subject  (Intercept) 1.139276 1.06737
 observer (Intercept) 0.051006 0.22585
 Residual             5.764072 2.40085
Number of obs: 776, groups: Subject, 41; observer, 3

Fixed effects:
            Estimate Std. Error t value
(Intercept)  5.06364    0.24664  20.530
NPP          0.04145    0.17406   0.238

Correlation of Fixed Effects:
    (Intr)
NPP -0.365
```

Table 4b: Model4: Random intercept for subjects, assuming random effect observer nested within NP

```
Linear mixed model fit by REML
Formula: Positioncon ~ NP + (1 | observer:NP) + Time + LeftRight + (1 |  Subject)
   Data: datlongnew
  AIC  BIC logLik deviance REMLdev
 2967 3014  -1474     2935    2947
Random effects:
 Groups      Name        Variance Std.Dev.
 Subject     (Intercept) 1.565930 1.25137
 observer:NP (Intercept) 0.080816 0.28428
 Residual                2.236095 1.49536
Number of obs: 776, groups: Subject, 41; observer:NP, 6

Fixed effects:
             Estimate Std. Error t value
(Intercept)  8.2179908  0.2947283   27.88
NPP          0.0859236  0.2592708    0.33
Time10min   -2.8467335  0.1684848  -16.90
Time15min   -4.4431723  0.1698605  -26.16
Time20min   -5.4651800  0.1726291  -31.66
TimeEnd     -3.2734640  0.1718250  -19.05
LeftRightR   0.0009402  0.1073678    0.01

Correlation of Fixed Effects:
           (Intr) NPP    Tm10mn Tm15mn Tm20mn TimEnd
NPP        -0.447
Time10min  -0.292 -0.004
Time15min  -0.290 -0.003  0.510
Time20min  -0.286 -0.003  0.502  0.502
TimeEnd    -0.286 -0.003  0.504  0.500  0.492
LeftRightR -0.182  0.000  0.000  0.000  0.000  0.000
```

Table 4c: Model5, Random intercept for subjects, and consider observer as cross randome effect which is by observer adjustment to NP, allowing different variances between group N and group P

```
Linear mixed model fit by REML
Formula: Positioncon ~ NP + (NP | observer) + Time + LeftRight + (1 | Subject)
   Data: datlongnew
  AIC  BIC logLik deviance REMLdev
 2970 3026  -1473     2933    2946
Random effects:
 Groups   Name        Variance   Std.Dev.   Corr
 Subject  (Intercept) 1.5571e+00 1.2478e+00
```

```
 observer (Intercept) 5.4113e-10 2.3262e-05
          NPP         2.0545e-01 4.5326e-01 0.000
 Residual             2.2336e+00 1.4945e+00
Number of obs: 776, groups: Subject, 41; observer, 3

Fixed effects:
             Estimate Std. Error t value
(Intercept)  8.1764701  0.2415645   33.85
NPP          0.1337157  0.2832529    0.47
Time10min   -2.8461424  0.1683909  -16.90
Time15min   -4.4422855  0.1697661  -26.17
Time20min   -5.4642911  0.1725324  -31.67
TimeEnd     -3.2728574  0.1717300  -19.06
LeftRightR   0.0008676  0.1073090    0.01

Correlation of Fixed Effects:
           (Intr) NPP    Tm10mn Tm15mn Tm20mn TimEnd
NPP        -0.084
Time10min  -0.356 -0.003
Time15min  -0.353 -0.003  0.510
Time20min  -0.348 -0.003  0.502  0.502
TimeEnd    -0.349 -0.003  0.504  0.500  0.492
LeftRightR -0.222  0.000  0.000  0.000  0.000  0.000
```

Table 4d: ANOVA, likehood ratio test to examine the model fit

```
Data: datlongnew
Models:
mod4: Positioncon ~ NP + (1 | observer:NP) + Time + LeftRight + (1 |
mod4:     Subject)
mod5: Positioncon ~ NP + (NP | observer) + Time + LeftRight + (1 |
mod5:     Subject)
     Df    AIC    BIC  logLik  Chisq Chi Df Pr(>Chisq)
mod4 10 2954.8 3001.3 -1467.4
mod5 12 2957.1 3013.0 -1466.5 1.6495      2     0.4383
```