Advanced Analysis

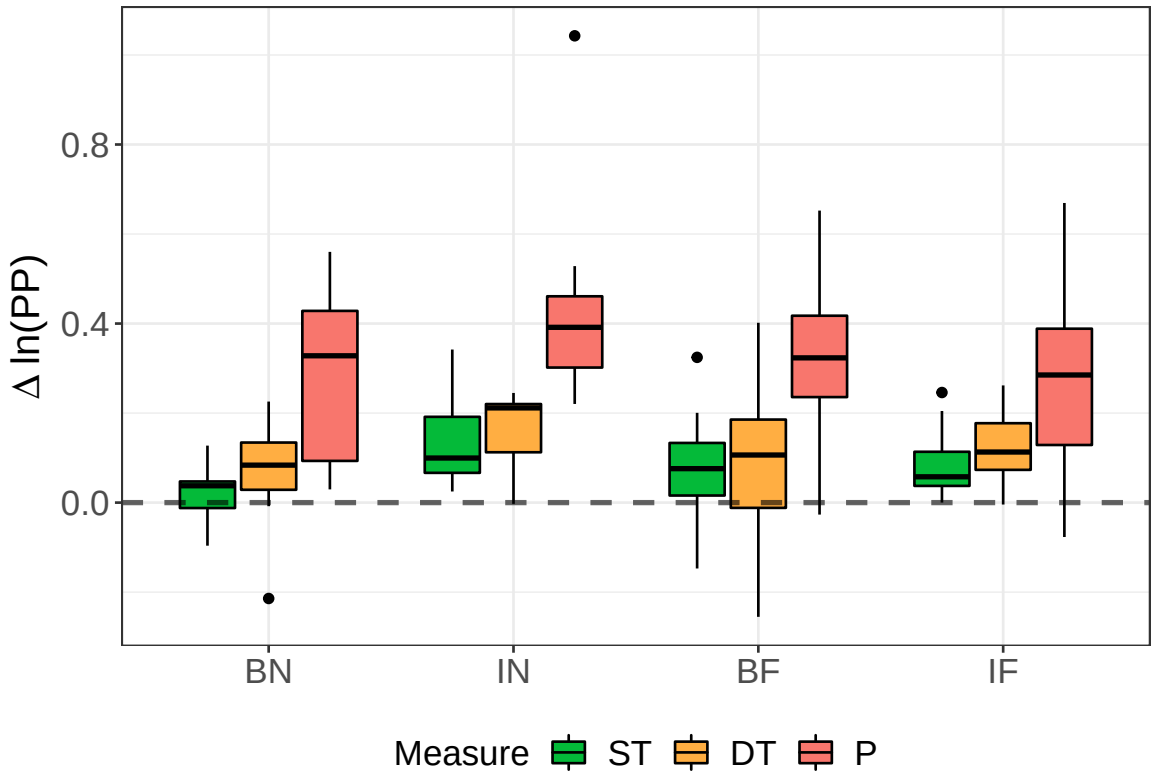
PP, 4 Groups:

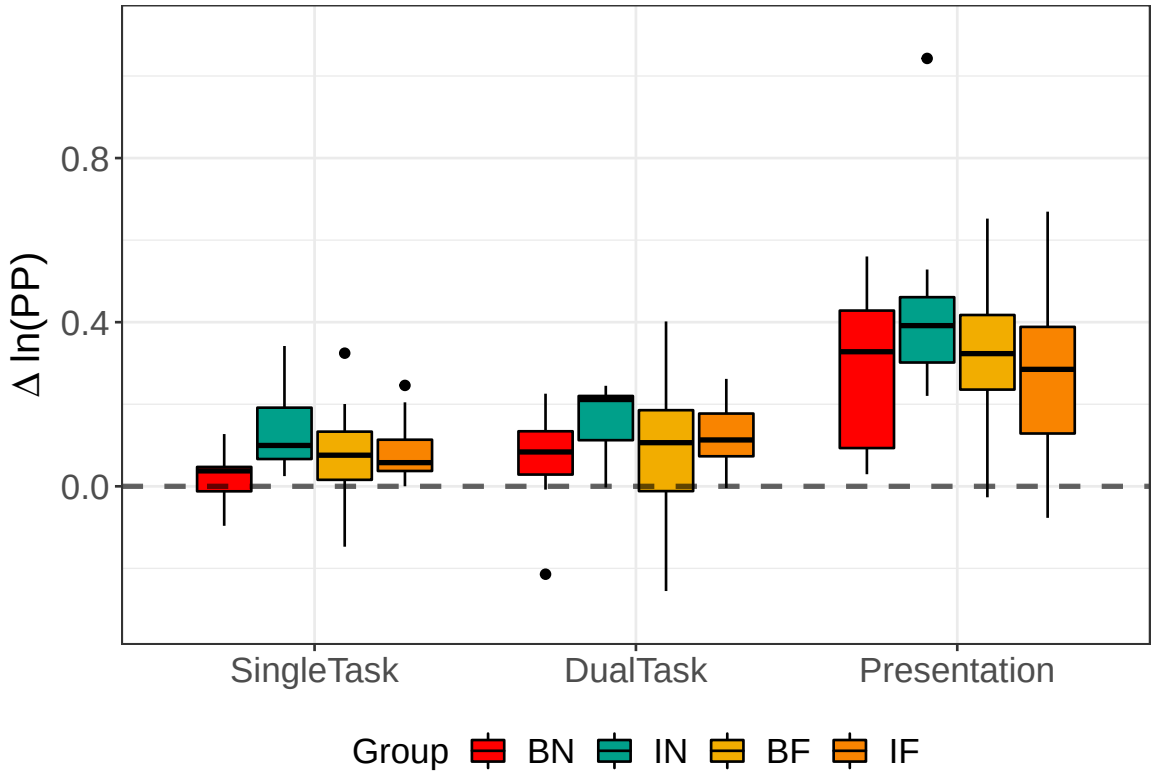
Stress Levels Across Activities

Our Linear Model:

$$\Delta ln(\bar{PP}) = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: diff_df
##         AIC       BIC   logLik
##   -217.9042 -188.0412 117.9521
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept) Residual
## StdDev:  0.08439434 0.109936
##
## Fixed effects: PP ~ 1 + Group + Activity
##                   Value  Std.Error  DF   t-value p-value
## (Intercept)  0.00405522 0.03310891 154  0.122481  0.9027
## GroupIN      0.13736382 0.04148696  50  3.311012  0.0017
## GroupBF      0.06887557 0.04013029  50  1.716299  0.0923
## GroupIF      0.07134866 0.04013029  50  1.777925  0.0815
## ActivityB   -0.02992264 0.02140325 154 -1.398042  0.1641
## ActivityDT   0.03060513 0.02115720 154  1.446559  0.1501
## ActivityP    0.24887255 0.02153411 154 11.557130  0.0000
##  Correlation:
##            (Intr) GropIN GropBF GropIF ActvtB ActvDT
## GroupIN    -0.678
## GroupBF    -0.700  0.558
## GroupIF    -0.700  0.558  0.578
## ActivityB  -0.320  0.000  0.006  0.006
## ActivityDT -0.320  0.000  0.000  0.000  0.494
## ActivityP  -0.310  0.005 -0.008 -0.008  0.485  0.491
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -2.80451618 -0.46110113 -0.05904604  0.49164957  4.97821652
##
## Number of Observations: 211
## Number of Groups: 54
```


0.8
0.4
0.0
Δ ln(PP)
BN
IN
BF
IF
Measure
ST
DT
P

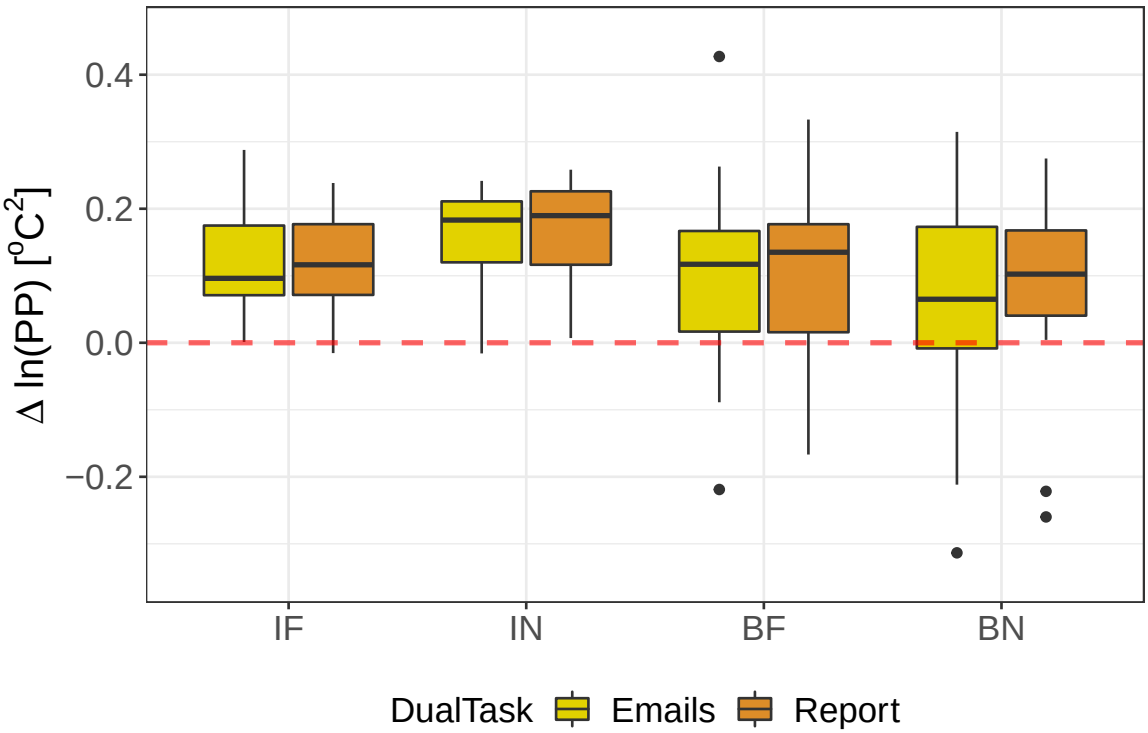

0.8
0.4
0.0
Δ ln(PP)
SingleTask
DualTask
Presentation
Group
BN
IN
BF
IF

Stress Levels for Dual Task

Our Linear Model:

$$\Delta ln(\bar{PP}) = 1 + Group + DualTask + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: total_df
##         AIC       BIC logLik
##   -222.1799 -203.7368 118.09
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)   Residual
## StdDev:   0.1202122 0.03066947
##
## Fixed effects: PP ~ 1 + Group + DualTask
##                     Value  Std.Error DF   t-value p-value
## (Intercept)    0.05597855 0.03538573 53 1.5819527  0.1196
## GroupIN        0.10154287 0.04890022 50 2.0765319  0.0430
## GroupBF        0.03914822 0.04805462 50 0.8146609  0.4191
## GroupIF        0.05875801 0.04730954 50 1.2419906  0.2200
## DualTaskReport 0.01016980 0.00590234 53 1.7230112  0.0907
##  Correlation:
##                (Intr) GropIN GropBF GropIF
## GroupIN        -0.719
## GroupBF        -0.731  0.529
## GroupIF        -0.743  0.537  0.547
## DualTaskReport -0.083  0.000  0.000  0.000
##
## Standardized Within-Group Residuals:
##        Min         Q1        Med         Q3        Max
## -2.5866795 -0.3712687  0.0181972  0.3073645  2.6038551
##
## Number of Observations: 108
## Number of Groups: 54
```



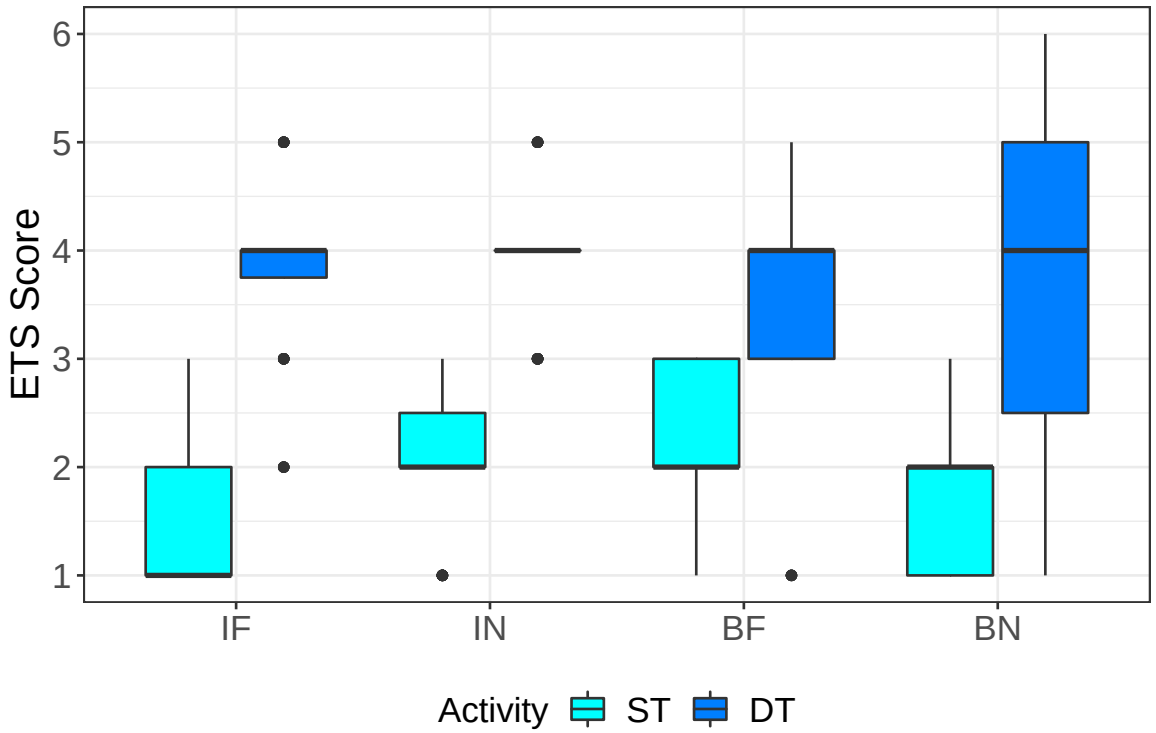

```
## Paired t-test
## For IF, p = 0.3643 > 0.05

## Paired t-test
## For IN, p = 0.0825 > 0.05

## Paired t-test
## For BF, p = 0.7465 > 0.05

## Paired t-test
## For BN, p = 0.3306 > 0.05
```

Linear Modelling for Writing Quality

Our Linear Model:

$$WritingQuality = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: full_df
##       AIC      BIC   logLik
##   814.222 842.1447 -400.111
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)  Residual
## StdDev:   0.7368648 0.5461497
##
## Fixed effects: Score ~ 1 + Group + Activity
##                 Value Std.Error  DF  t-value p-value
## (Intercept) 1.6667483 0.2329475 351  7.15504  0.0000
## GroupIN     0.4034307 0.3040668  48  1.32678  0.1909
## GroupBF     0.3972397 0.3194899  48  1.24336  0.2198
## GroupIF     0.1122665 0.3097909  48  0.36239  0.7186
## ActivityDT  1.8663366 0.0543439 351 34.34306  0.0000
##  Correlation:
##             (Intr) GropIN GropBF GropIF
## GroupIN    -0.756
## GroupBF    -0.719  0.551
## GroupIF    -0.742  0.568  0.541
## ActivityDT -0.117  0.000  0.000  0.000
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -2.72900544 -0.72894866 -0.02674991  0.76816710  2.51925629
##
## Number of Observations: 404
## Number of Groups: 52
```



Activity	Group	n
ST	BN	43
ST	IN	59
ST	BF	48
ST	IF	52
DT	BN	43
DT	IN	59
DT	BF	48
DT	IF	52

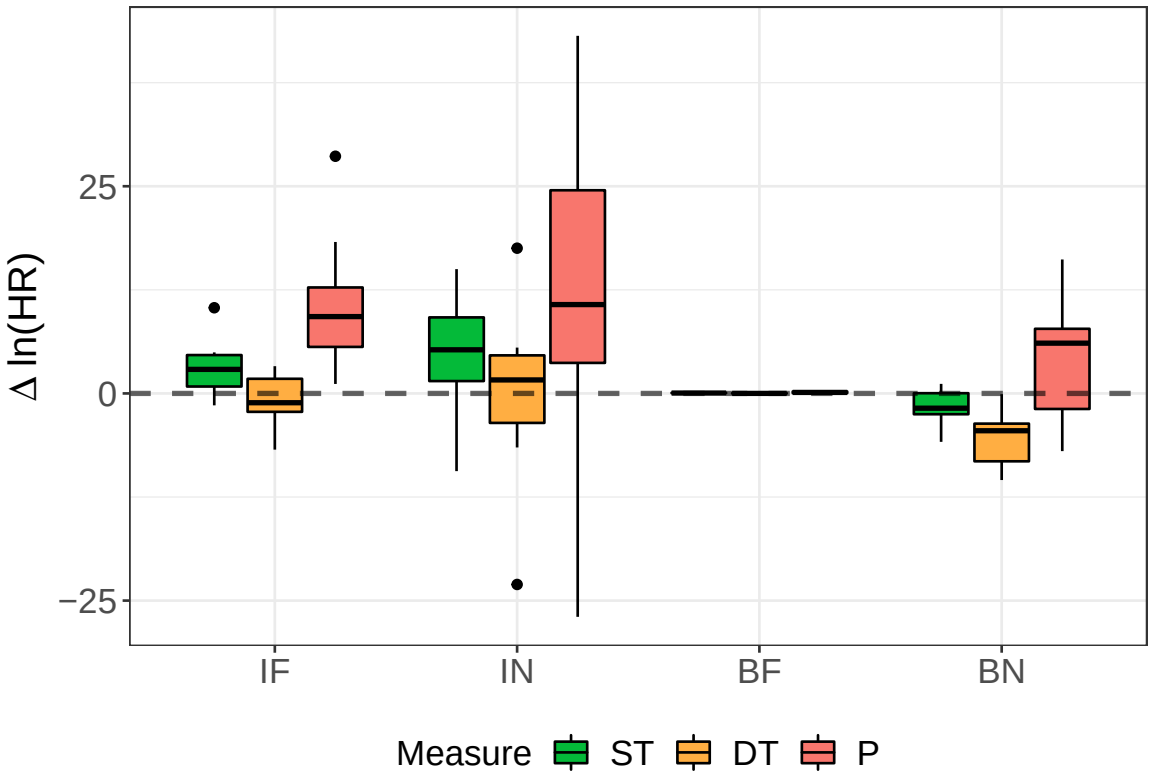
HR, 4 Groups:

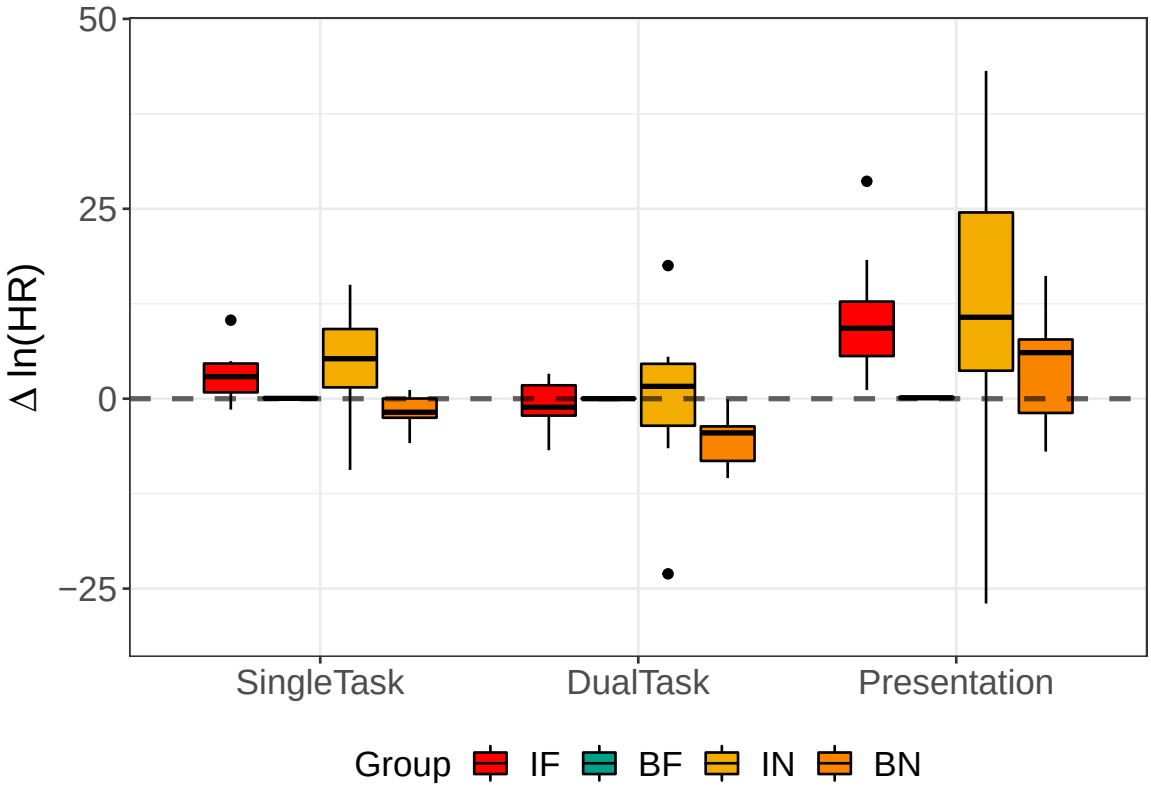
Stress Levels Across Activities

Our Linear Model:

$$\Delta \bar{HR} = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: diff_df
##        AIC      BIC    logLik
##   1167.934 1196.314 -574.9671
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept) Residual
## StdDev:    4.611047  5.27251
##
## Fixed effects: HR ~ 1 + Group + Activity
##                 Value Std.Error  DF   t-value p-value
## (Intercept) -0.460108  2.006015 130 -0.229364  0.8189
## GroupIN      4.116425  2.375528  43  1.732846  0.0903
## GroupBF      0.731044  2.371155  43  0.308307  0.7593
## GroupIF      3.855041  2.491648  43  1.547185  0.1291
## ActivityB   -2.385293  1.095374 130 -2.177606  0.0312
## ActivityDT  -2.921984  1.087636 130 -2.686547  0.0082
## ActivityP    4.902909  1.145331 130  4.280781  0.0000
##  Correlation:
##             (Intr) GropIN GropBF GropIF ActvtB ActvDT
## GroupIN     -0.754
## GroupBF     -0.754  0.638
## GroupIF     -0.719  0.607  0.609
## ActivityB   -0.272  0.000  0.000  0.008
## ActivityDT -0.271  0.000  0.000  0.000  0.496
## ActivityP   -0.248 -0.003 -0.014 -0.010  0.474  0.475
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.58925639 -0.50460601 -0.01629113  0.42226149  5.18860807
##
## Number of Observations: 180
## Number of Groups: 47
```


Δ ln(HR)
25
0
−25
IF
IN
BF
BN
Measure
ST
DT
P

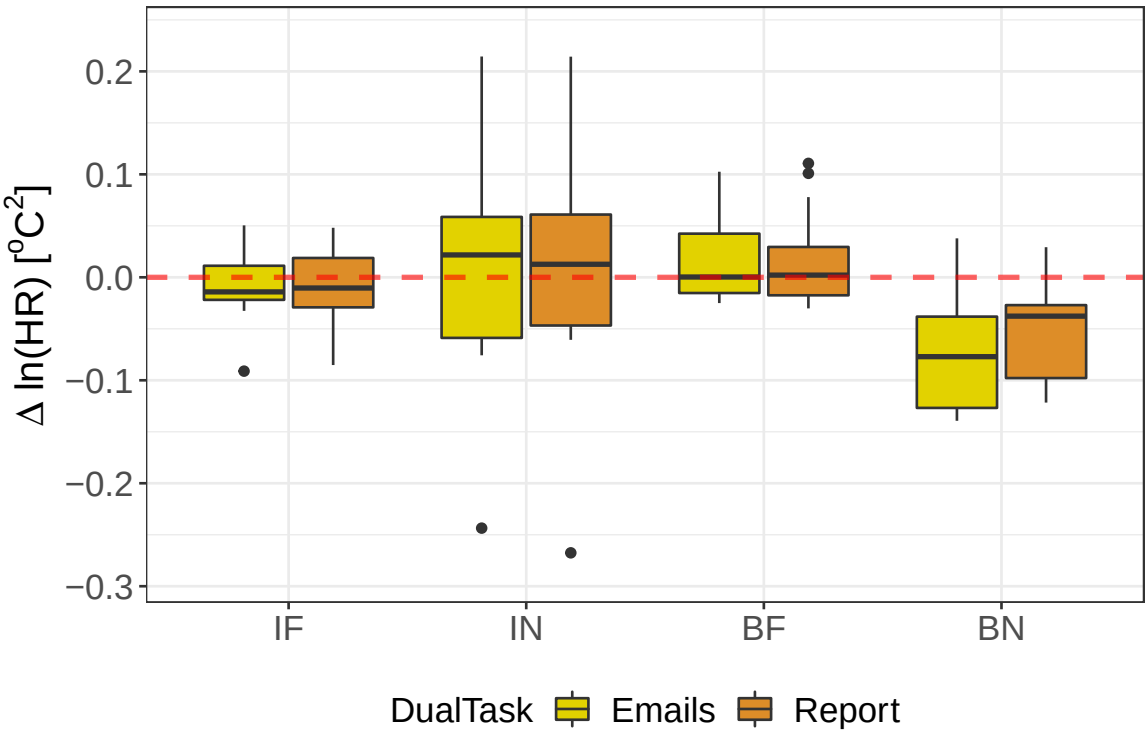

Δ ln(HR)
50
25
0
−25
SingleTask
DualTask
Presentation
Group
IF
BF
IN
BN

Stress Levels for Dual Task

Our Linear Model:

$$\Delta\bar{HR} = 1 + Group + DualTask + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: total_df
##         AIC       BIC   logLik
##   -297.1249 -279.8636 155.5625
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)   Residual
## StdDev:  0.06866781 0.01487866
##
## Fixed effects: HR ~ 1 + Group + DualTask
##                       Value  Std.Error DF   t-value p-value
## (Intercept)    -0.06303756 0.02460997 45 -2.561464  0.0138
## GroupIN         0.06463792 0.03078889 42  2.099391  0.0418
## GroupBF         0.07909728 0.03121653 42  2.533827  0.0151
## GroupIF         0.05271283 0.03227952 42  1.633012  0.1099
## DualTaskReport  0.00378468 0.00310241 45  1.219914  0.2289
##  Correlation:
##                (Intr) GropIN GropBF GropIF
## GroupIN        -0.796
## GroupBF        -0.785  0.628
## GroupIF        -0.759  0.607  0.599
## DualTaskReport -0.063  0.000  0.000  0.000
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -1.57573720 -0.44301705 -0.03874386  0.49969482  1.76241874
##
## Number of Observations: 92
## Number of Groups: 46
```



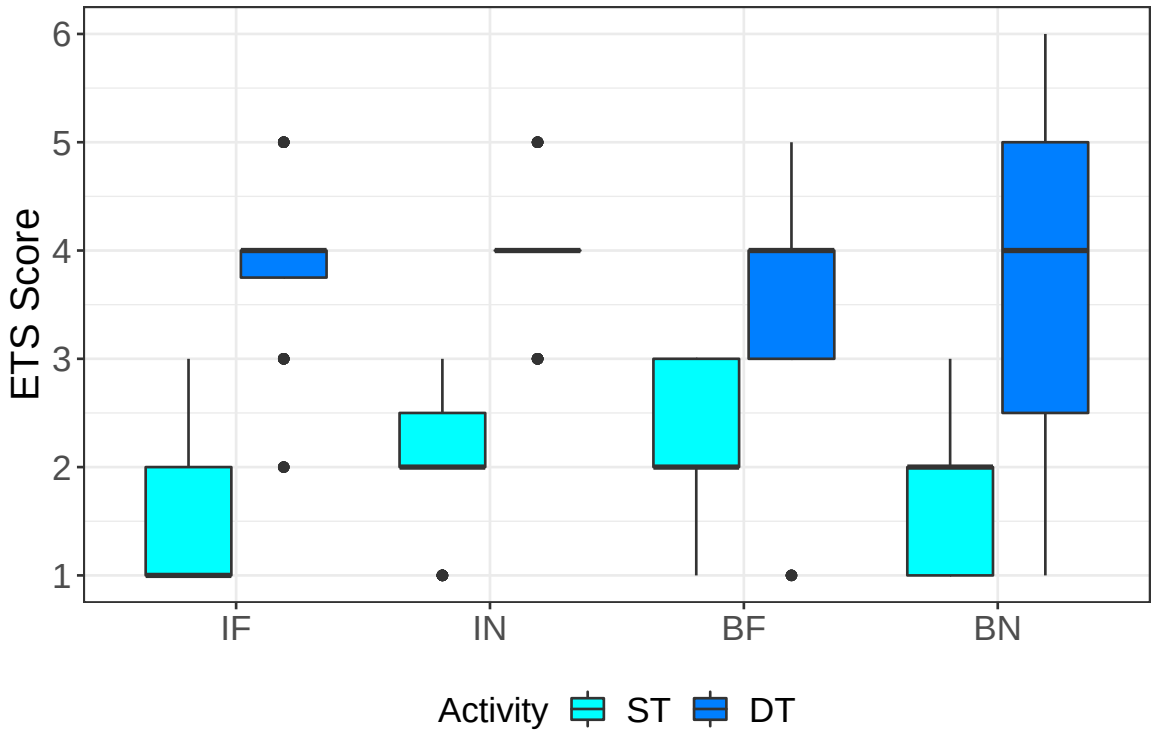

```
## Paired t-test
## For IF, p = 0.7175 > 0.05

## Paired t-test
## For IN, p = 0.8392 > 0.05

## Paired t-test
## For BF, p = 0.8956 > 0.05

## Paired t-test
## For BN, p = 0.1669 > 0.05
```

Linear Modelling for Writing Quality

Our Linear Model:

$$WritingQuality = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: full_df
##       AIC      BIC   logLik
##   814.222 842.1447 -400.111
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)  Residual
## StdDev:   0.7368648 0.5461497
##
## Fixed effects: Score ~ 1 + Group + Activity
##                 Value Std.Error  DF  t-value p-value
## (Intercept) 1.6667483 0.2329475 351  7.15504  0.0000
## GroupIN     0.4034307 0.3040668  48  1.32678  0.1909
## GroupBF     0.3972397 0.3194899  48  1.24336  0.2198
## GroupIF     0.1122665 0.3097909  48  0.36239  0.7186
## ActivityDT  1.8663366 0.0543439 351 34.34306  0.0000
##  Correlation:
##             (Intr) GropIN GropBF GropIF
## GroupIN    -0.756
## GroupBF    -0.719  0.551
## GroupIF    -0.742  0.568  0.541
## ActivityDT -0.117  0.000  0.000  0.000
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -2.72900544 -0.72894866 -0.02674991  0.76816710  2.51925629
##
## Number of Observations: 404
## Number of Groups: 52
```



Activity	Group	n
ST	BN	43
ST	IN	59
ST	BF	48
ST	IF	52
DT	BN	43
DT	IN	59
DT	BF	48
DT	IF	52

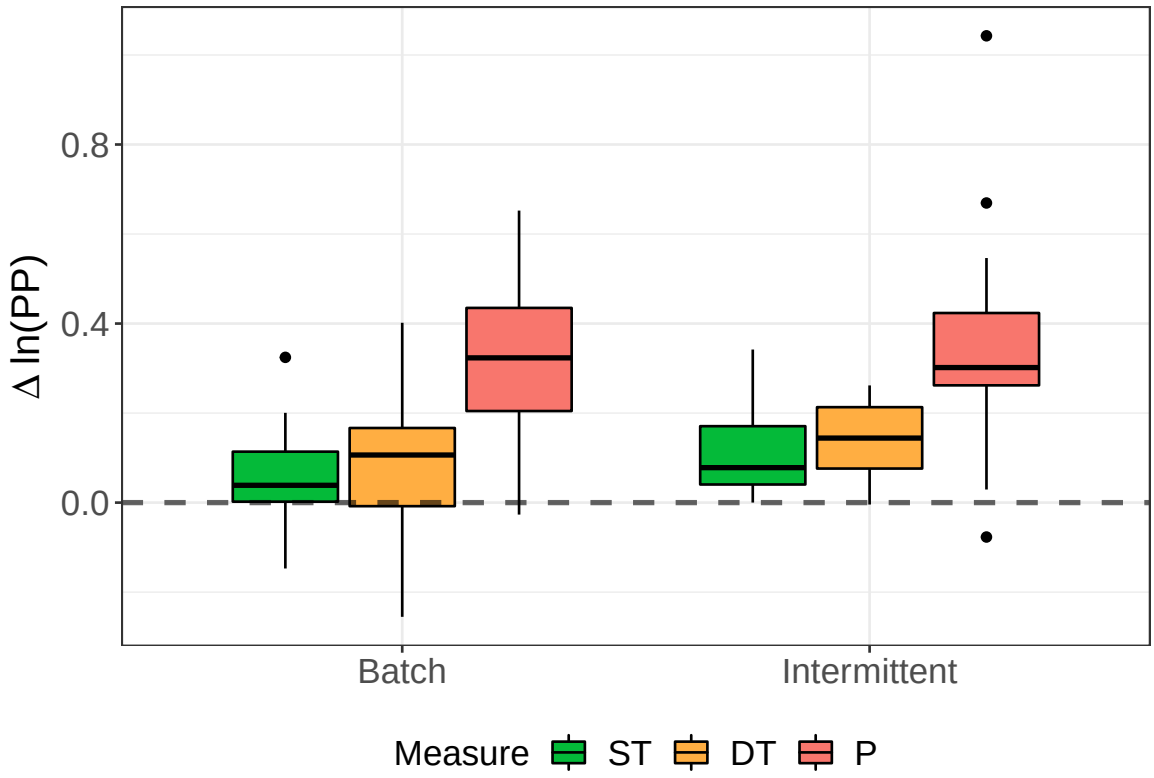
PP, 2 Groups:

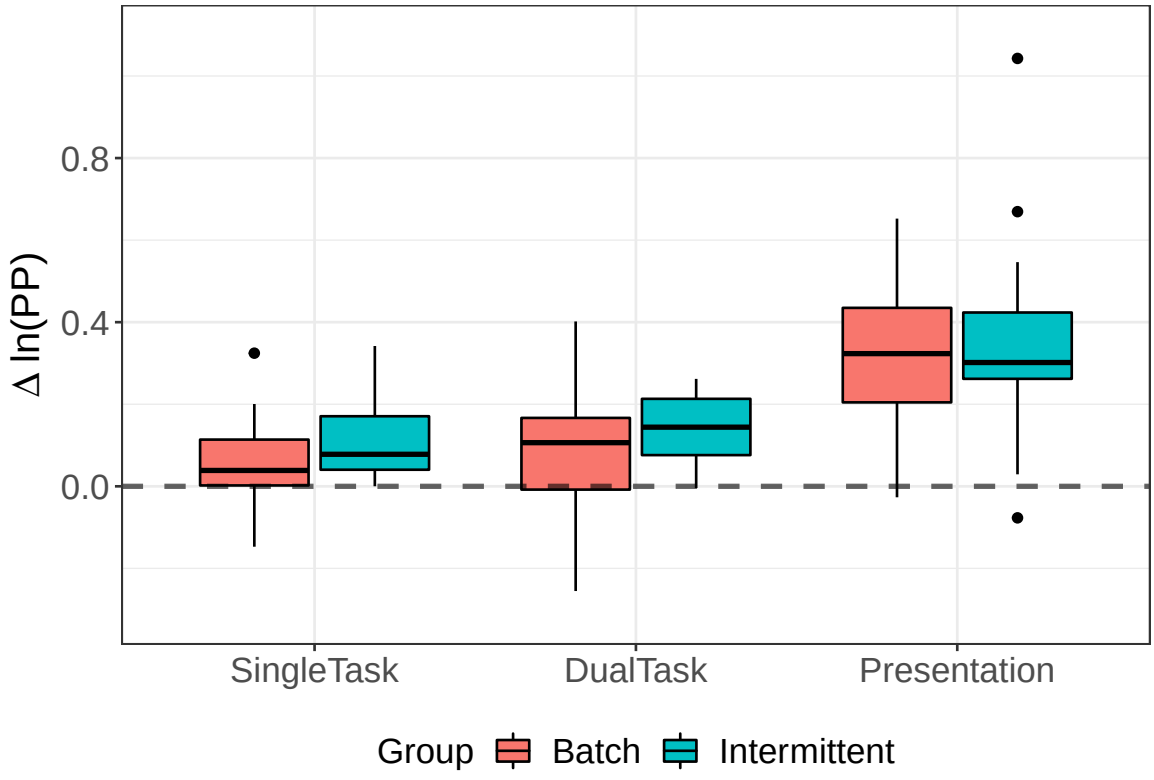
Stress Levels Across Activities

Our Linear Model:

$$\Delta ln(\bar{PP}) = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: diff_df
##         AIC       BIC   logLik
##   -225.4127 -202.1176 119.7064
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)  Residual
## StdDev:  0.08889621 0.1099188
##
## Fixed effects: PP ~ 1 + Group + Activity
##                         Value  Std.Error  DF   t-value p-value
## (Intercept)        0.04380778 0.02428221 154  1.804110  0.0732
## GroupIntermittent  0.06223053 0.02857538  52  2.177768  0.0340
## ActivityB         -0.02988212 0.02140078 154 -1.396310  0.1646
## ActivityDT         0.03060513 0.02115387 154  1.446786  0.1500
## ActivityP          0.24849040 0.02153051 154 11.541317  0.0000
##  Correlation:
##                   (Intr) GrpInt ActvtB ActvDT
## GroupIntermittent -0.610
## ActivityB         -0.430  0.000
## ActivityDT        -0.436  0.000  0.494
## ActivityP         -0.430  0.004  0.485  0.491
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -2.85344933 -0.44797216 -0.02754228  0.46481810  5.04181822
##
## Number of Observations: 211
## Number of Groups: 54
```


0.8
0.4
0.0
Δ ln(PP)
Batch
Intermittent
Measure
ST
DT
P

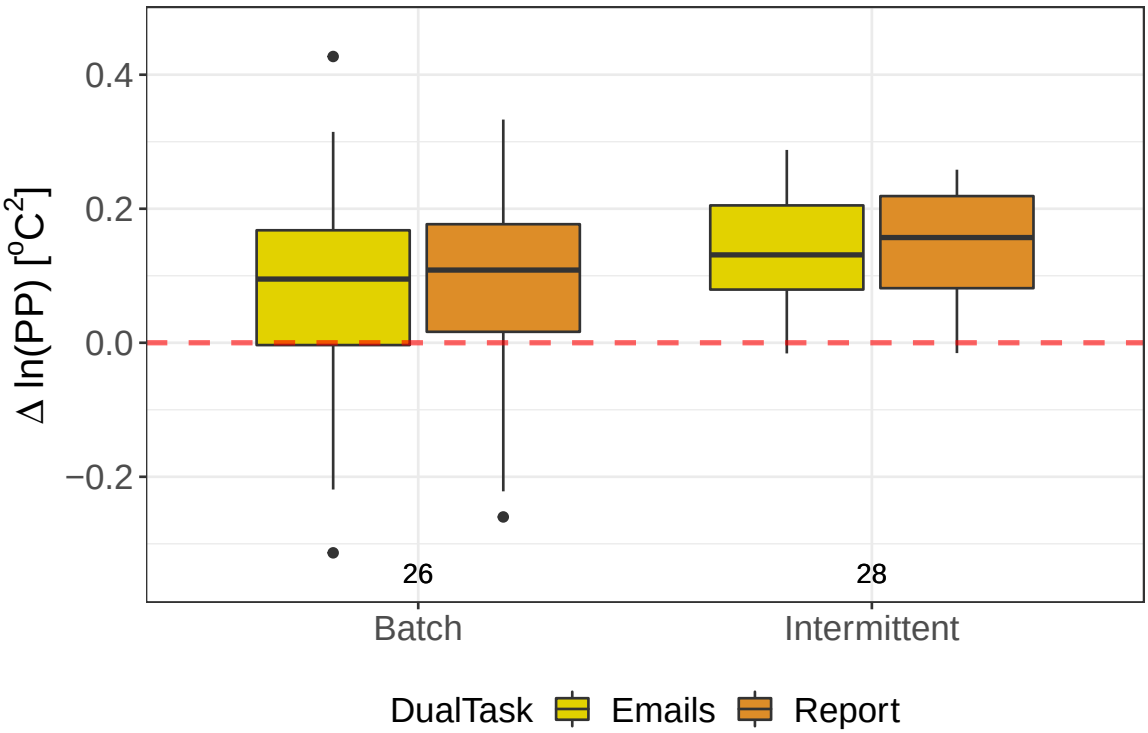

0.8
0.4
0.0
Δ ln(PP)
SingleTask
DualTask
Presentation
Group
Batch
Intermittent

Stress Levels for Dual Task

Our Linear Model:

$$\Delta ln(\bar{PP}) = 1 + Group + DualTask + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: total_df
##        AIC       BIC   logLik
##   -233.205 -219.9352 121.6025
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)   Residual
## StdDev:   0.1196356 0.03066947
##
## Fixed effects: PP ~ 1 + Group + DualTask
##                         Value  Std.Error DF  t-value p-value
## (Intercept)       0.07705836 0.02402678 53 3.207186  0.0023
## GroupIntermittent 0.05754260 0.03311406 52 1.737709  0.0882
## DualTaskReport    0.01016980 0.00590234 53 1.723011  0.0907
##  Correlation:
##                   (Intr) GrpInt
## GroupIntermittent -0.715
## DualTaskReport    -0.123  0.000
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -2.60846594 -0.34915701  0.01252142  0.28596138  2.58206907
##
## Number of Observations: 108
## Number of Groups: 54
```



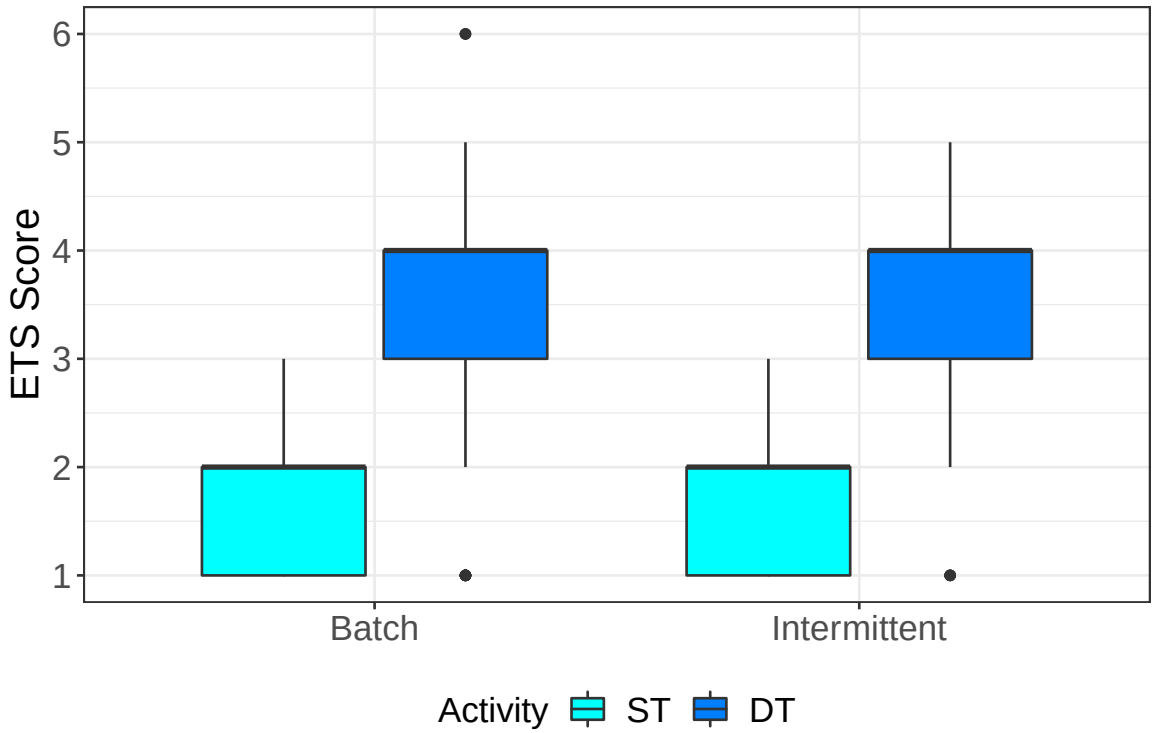

```
## Paired t-test
## For Batch, p = 0.3528 > 0.05

## Paired t-test
## For Intermittent, p = 0.0525 > 0.05
```

Linear Modelling for Writing Quality

Our Linear Model:

$$WritingQuality = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: full_df
##        AIC      BIC    logLik
##   811.7688 831.7386 -400.8844
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)  Residual
## StdDev:   0.7417761 0.5461764
##
## Fixed effects: Score ~ 1 + Group + Activity
##                       Value  Std.Error  DF  t-value p-value
## (Intercept)       1.9002441 0.15348066 351 12.38100  0.0000
## GroupIntermittent 0.0117149 0.21387747  50  0.05477  0.9565
## ActivityDT        1.8663366 0.05434659 351 34.34138  0.0000
##  Correlation:
##                   (Intr) GrpInt
## GroupIntermittent -0.695
## ActivityDT        -0.177  0.000
##
## Standardized Within-Group Residuals:
##          Min           Q1          Med           Q3          Max
## -2.749554137 -0.731430647 -0.008304264  0.752987193  2.498450738
##
## Number of Observations: 404
## Number of Groups: 52
```



Activity	Group	n
ST	Batch	102
ST	Intermittent	100
DT	Batch	102
DT	Intermittent	100

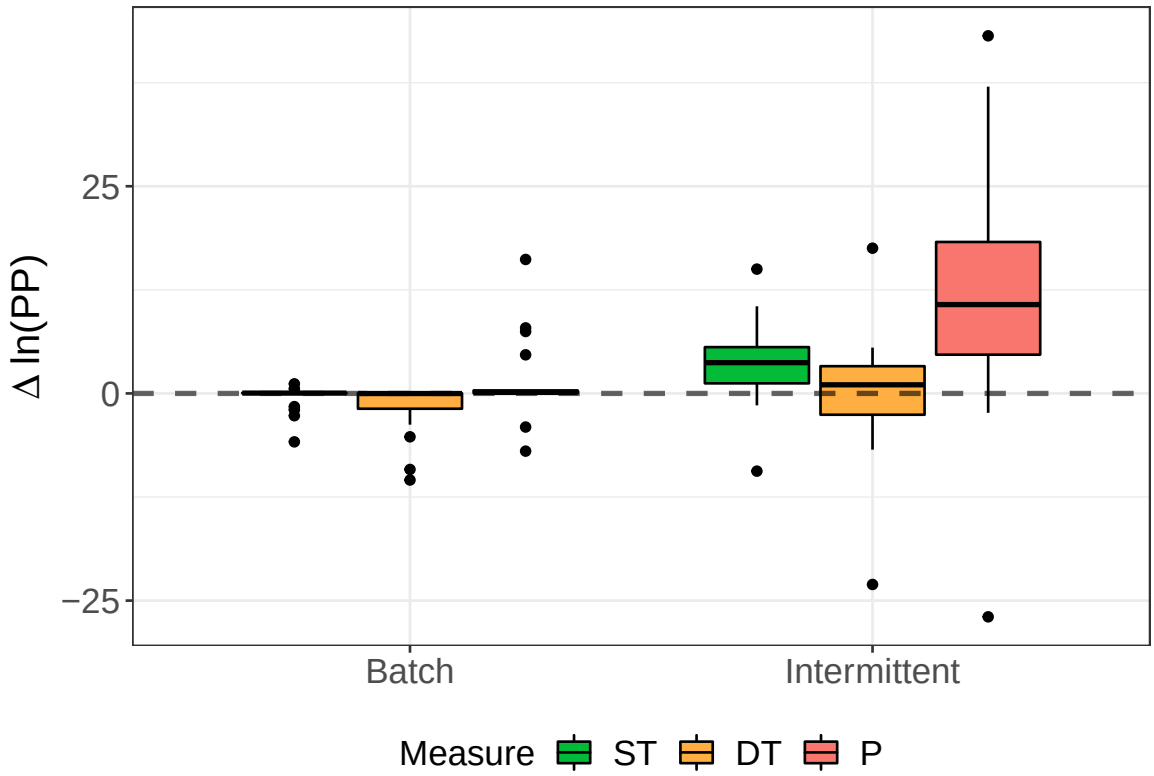
HR, 2 Groups:

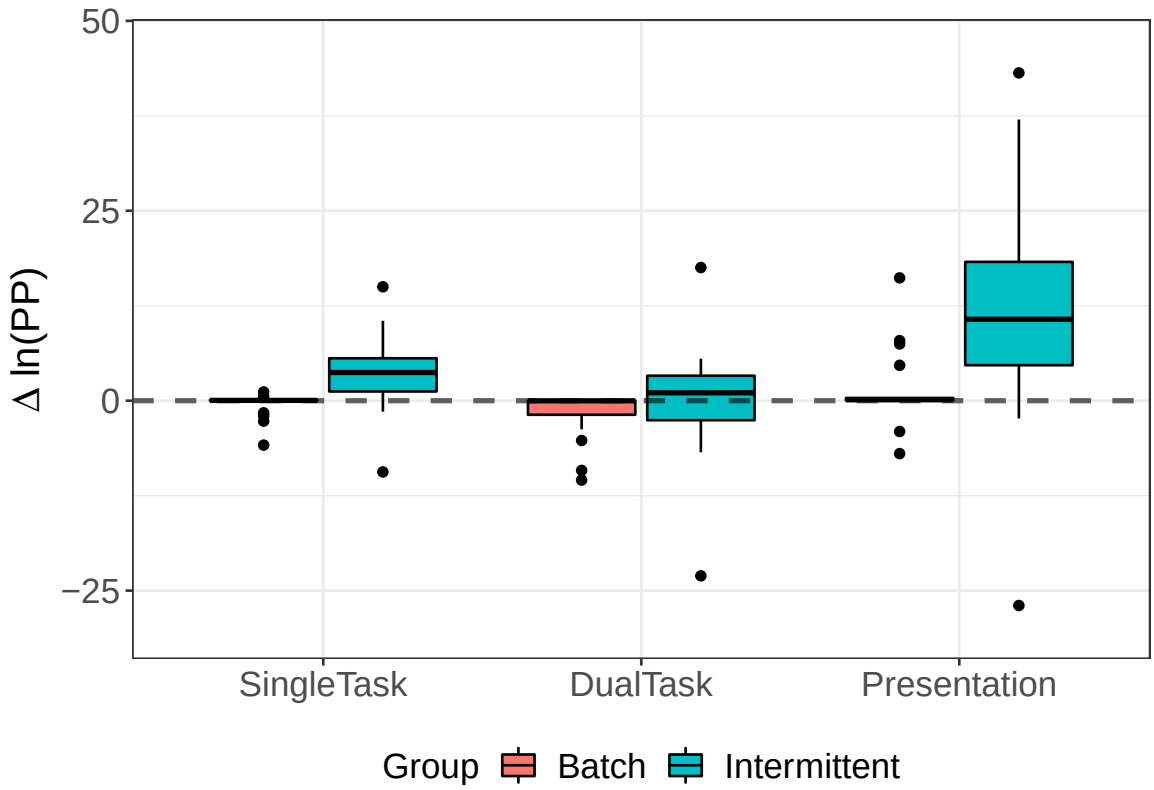
Stress Levels Across Activities

Our Linear Model:

$$\Delta\bar{H}R = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: diff_df
##        AIC      BIC   logLik
##   1170.946 1193.099 -578.473
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept) Residual
## StdDev:    4.481114 5.271894
##
## Fixed effects: HR ~ 1 + Group + Activity
##                       Value Std.Error  DF   t-value p-value
## (Intercept)        0.004958  1.296684 130  0.003824  0.9970
## GroupIntermittent  3.536476  1.530566  45  2.310567  0.0255
## ActivityB         -2.383440  1.095157 130 -2.176345  0.0313
## ActivityDT        -2.921984  1.087509 130 -2.686861  0.0082
## ActivityP          4.908475  1.144838 130  4.287485  0.0000
##  Correlation:
##                   (Intr) GrpInt ActvtB ActvDT
## GroupIntermittent -0.628
## ActivityB         -0.420  0.006
## ActivityDT        -0.419  0.000  0.497
## ActivityP         -0.401  0.004  0.475  0.475
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.62964871 -0.49214954 -0.01180449  0.43107110  5.21355141
##
## Number of Observations: 180
## Number of Groups: 47
```


Δ ln(PP)
25
0
−25
Batch
Intermittent
Measure
ST
DT
P

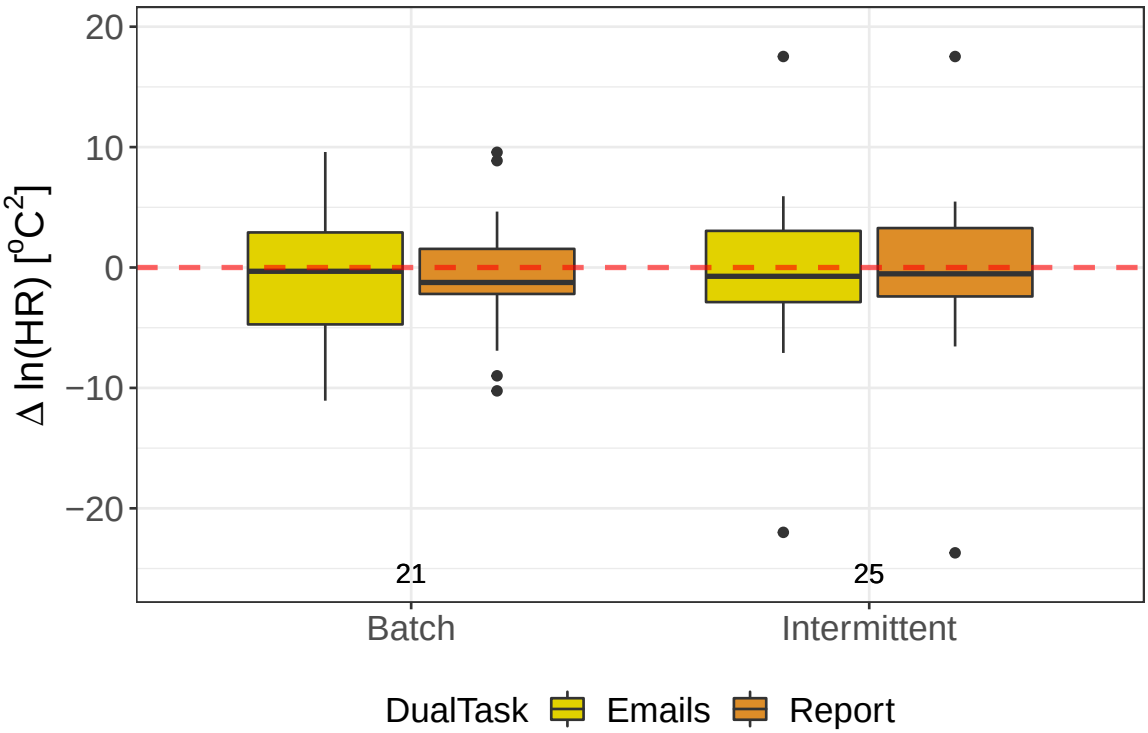

Δ ln(PP)
50
25
0
−25
SingleTask
DualTask
Presentation
Group
Batch
Intermittent

Stress Levels for Dual Task

Our Linear Model:

$$\Delta\bar{HR} = 1 + Group + DualTask + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: total_df
##        AIC      BIC    logLik
##   472.5203 484.9635 -231.2601
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept) Residual
## StdDev:    5.977237 1.124413
##
## Fixed effects: HR ~ 1 + Group + DualTask
##                         Value Std.Error DF    t-value p-value
## (Intercept)       -1.0340572 1.3210404 45 -0.7827597  0.4379
## GroupIntermittent  0.5268177 1.7848769 44  0.2951563  0.7693
## DualTaskReport     0.3088114 0.2344563 45  1.3171382  0.1945
##  Correlation:
##                   (Intr) GrpInt
## GroupIntermittent -0.734
## DualTaskReport    -0.089  0.000
##
## Standardized Within-Group Residuals:
##          Min           Q1          Med           Q3          Max
## -1.766605064 -0.436180635 -0.005407971  0.509799583  1.997952625
##
## Number of Observations: 92
## Number of Groups: 46
```



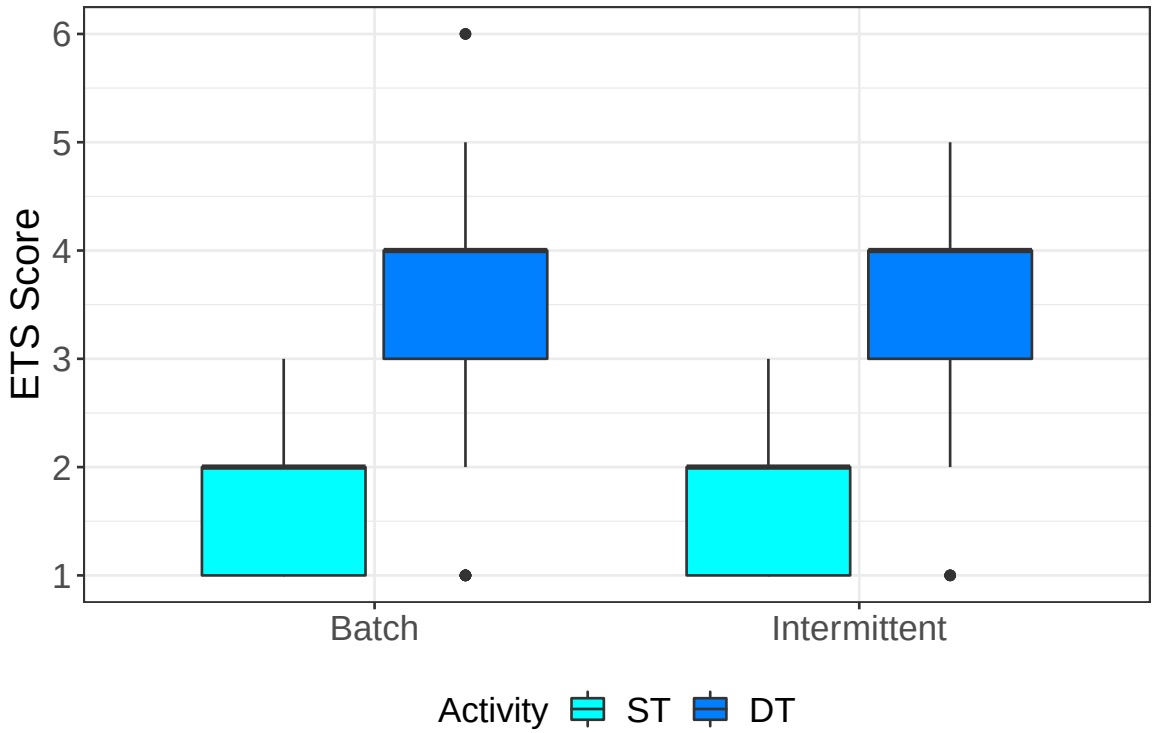

```
## Paired t-test
## For Batch, p = 0.2583 > 0.05

## Paired t-test
## For Intermittent, p = 0.5442 > 0.05
```

Linear Modelling for Writing Quality

Our Linear Model:

$$WritingQuality = 1 + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: full_df
##        AIC      BIC    logLik
##   811.7688 831.7386 -400.8844
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)  Residual
## StdDev:   0.7417761 0.5461764
##
## Fixed effects: Score ~ 1 + Group + Activity
##                       Value  Std.Error  DF  t-value p-value
## (Intercept)       1.9002441 0.15348066 351 12.38100  0.0000
## GroupIntermittent 0.0117149 0.21387747  50  0.05477  0.9565
## ActivityDT        1.8663366 0.05434659 351 34.34138  0.0000
##  Correlation:
##                   (Intr) GrpInt
## GroupIntermittent -0.695
## ActivityDT        -0.177  0.000
##
## Standardized Within-Group Residuals:
##          Min           Q1          Med           Q3          Max
## -2.749554137 -0.731430647 -0.008304264  0.752987193  2.498450738
##
## Number of Observations: 404
## Number of Groups: 52
```



Activity	Group	n
ST	Batch	102
ST	Intermittent	100
DT	Batch	102
DT	Intermittent	100

Let's Get to 10 $\star$ with Four Groups

Our Linear Model:

$$\Delta ln(\bar{PP}) = 1 + ETSScore + Group + Activity + 1|Subject$$

```
## Linear mixed-effects model fit by REML
##  Data: full_df
##         AIC       BIC   logLik
##   -148.1437 -127.9694 82.07187
##
## Random effects:
##  Formula: ~1 | Subject
##         (Intercept)   Residual
## StdDev:  0.08708762 0.05924682
##
## Fixed effects: PP ~ 1 + ETSScore + Group + Activity
##                   Value  Std.Error DF   t-value p-value
## (Intercept)  0.01825213 0.03409999 47  0.535253  0.5950
## ETSScore    -0.01143289 0.01002932 47 -1.139946  0.2601
## GroupIN      0.14559723 0.03984458 45  3.654129  0.0007
## GroupBF      0.04423412 0.04054805 45  1.090906  0.2811
## GroupIF      0.07491421 0.03959597 45  1.891965  0.0649
## ActivityDT   0.04942296 0.02214038 47  2.232255  0.0304
##  Correlation:
##             (Intr) ETSScr GropIN GropBF GropIF
## ETSScore    -0.489
## GroupIN     -0.570 -0.113
## GroupBF     -0.565 -0.101  0.537
## GroupIF     -0.621 -0.016  0.540  0.530
## ActivityDT  0.316 -0.841  0.095  0.085  0.013
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -1.82718410 -0.50237965  0.04256535  0.41823819  1.95797921
##
## Number of Observations: 98
## Number of Groups: 49
```