Bilingualism

R Markdown

We load the data and remove the cases with NA values.

```
str(D1)
```

```
## 'data.frame':    225 obs. of  16 variables:
##  $ Hand  : Factor w/ 2 levels "0","1": 1 2 2 2 2 1 2 1 1 2 ...
##  $ EO    : Factor w/ 2 levels "0","1": 2 2 2 1 2 2 2 2 2 2 ...
##  $ List  : Factor w/ 2 levels "0","1": 1 1 2 1 2 2 2 1 1 2 ...
##  $ CEF   : Ord.factor w/ 3 levels "3"<"4"<"5": 1 1 2 2 3 3 3 2 3 1 ...
##  $ SRRC  : int  4 3 3 3 4 3 3 4 3 2 ...
##  $ PRE   : num  61.1 83.3 44.4 44.4 55.6 94.4 77.8 88.8 77.8 72.2 ...
##  $ POST1 : num  94.4 100 94.4 94.4 94.4 100 100 100 100 100 ...
##  $ POST2 : num  100 100 100 100 100 100 100 100 87.5 100 ...
##  $ STAY  : Factor w/ 2 levels "0","1": 1 1 1 1 1 2 1 1 1 1 ...
##  $ LEAYRS: num  1 2 3 3 11 3 4 4 2 3 ...
##  $ HRSD  : num  1 1 0 2 5 2.5 0 1.5 0.5 0 ...
##  $ RPV   : num  3 3.5 3.5 4 2 2.5 2.5 1 1.5 3 ...
##  $ AMGE  : num  4.5 4.5 4 4 4 4 4 4.5 4 3.5 ...
##  $ AMSP  : num  4 4 3 3 4.67 ...
##  $ time  : num  1162 815 928 969 1190 ...
##  $ type  : Factor w/ 2 levels "MATCH","MISMATCH": 1 1 1 1 1 1 1 1 1 1 ...
```

In total we have 225 data points.

Multiple Linear Regression

We try first a first order multiple linear regression model

```
m<-lm(data=D1,time~.)
print(anova(m),signif.stars=TRUE)
```

```
## Analysis of Variance Table
##
## Response: time
##            Df   Sum Sq Mean Sq F value  Pr(>F)
## Hand        1  1566311 1566311   13.12 0.00037 ***
## EO          1   406132  406132    3.40 0.06657 .
## List        1    32646   32646    0.27 0.60162
## CEF         2   311627  155814    1.30 0.27341
## SRRC        1    48892   48892    0.41 0.52295
## PRE         1   176563  176563    1.48 0.22536
## POST1       1  1753898 1753898   14.69 0.00017 ***
## POST2       1   470449  470449    3.94 0.04847 *
## STAY        1     1062    1062    0.01 0.92497
## LEAYRS      1   895489  895489    7.50 0.00671 **
## HRSD        1   306396  306396    2.57 0.11070
```

```
## RPV         1    28814   28814    0.24 0.62378
## AMGE        1        4       4    0.00 0.99555
## AMSP        1   144975  144975    1.21 0.27179
## type        1     5742    5742    0.05 0.82665
## Residuals 208 24836773  119408
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

and then we include all second order terms:

```
library(MASS)
m2<-lm(data=D1,time~.^2)
print(anova(m2),signif.stars=TRUE)
```

```
## Analysis of Variance Table
##
## Response: time
##               Df  Sum Sq Mean Sq F value  Pr(>F)
## Hand           1 1566311 1566311   25.76 1.9e-06 ***
## EO             1  406132  406132    6.68 0.01126 *
## List           1   32646   32646    0.54 0.46550
## CEF            2  311627  155814    2.56 0.08237 .
## SRRC           1   48892   48892    0.80 0.37211
## PRE            1  176563  176563    2.90 0.09160 .
## POST1          1 1753898 1753898   28.85 5.5e-07 ***
## POST2          1  470449  470449    7.74 0.00651 **
## STAY           1    1062    1062    0.02 0.89515
## LEAYRS         1  895489  895489   14.73 0.00022 ***
## HRSD           1  306396  306396    5.04 0.02708 *
## RPV            1   28814   28814    0.47 0.49286
## AMGE           1       4       4    0.00 0.99377
## AMSP           1  144975  144975    2.38 0.12585
## type           1    5742    5742    0.09 0.75929
## Hand:EO        1   62203   62203    1.02 0.31434
## Hand:List      1  194201  194201    3.19 0.07707 .
## Hand:CEF       2  217284  108642    1.79 0.17302
## Hand:SRRC      1  112472  112472    1.85 0.17699
## Hand:PRE       1    3724    3724    0.06 0.80507
## Hand:POST1     1  188633  188633    3.10 0.08136 .
## Hand:POST2     1  145198  145198    2.39 0.12556
## Hand:STAY      1  637948  637948   10.49 0.00165 **
## Hand:LEAYRS    1  457619  457619    7.53 0.00726 **
## Hand:HRSD      1   24098   24098    0.40 0.53048
## Hand:RPV       1  347411  347411    5.71 0.01878 *
## Hand:AMGE      1  606456  606456    9.97 0.00212 **
## Hand:type      1  312008  312008    5.13 0.02574 *
## EO:CEF         2  118659   59330    0.98 0.38061
## EO:SRRC        1    4128    4128    0.07 0.79500
## EO:PRE         1   21422   21422    0.35 0.55420
## EO:POST1       1  573061  573061    9.42 0.00278 **
## EO:POST2       1   67388   67388    1.11 0.29509
## EO:STAY        1  199644  199644    3.28 0.07311 .
## EO:LEAYRS      1  290394  290394    4.78 0.03129 *
```

```
## EO:HRSD       1     913     913    0.02 0.90275
## EO:RPV        1       4       4    0.00 0.99325
## EO:AMGE       1   28182   28182    0.46 0.49763
## EO:AMSP       1  165323  165323    2.72 0.10243
## EO:type       1   62248   62248    1.02 0.31417
## List:CEF      2  323038  161519    2.66 0.07536 .
## List:SRRC     1   38648   38648    0.64 0.42727
## List:PRE      1   14853   14853    0.24 0.62226
## List:POST1    1 1225608 1225608   20.16 2.0e-05 ***
## List:POST2    1  346642  346642    5.70 0.01891 *
## List:STAY     1  323881  323881    5.33 0.02315 *
## List:LEAYRS   1  185254  185254    3.05 0.08410 .
## List:HRSD     1   57262   57262    0.94 0.33426
## List:RPV      1   16026   16026    0.26 0.60885
## List:AMGE     1    1491    1491    0.02 0.87591
## List:AMSP     1  194107  194107    3.19 0.07714 .
## List:type     1  736518  736518   12.11 0.00075 ***
## CEF:SRRC      2  775217  387608    6.37 0.00251 **
## CEF:PRE       2   27613   13806    0.23 0.79729
## CEF:POST1     2  297854  148927    2.45 0.09173 .
## CEF:POST2     2  937640  468820    7.71 0.00078 ***
## CEF:STAY      2  671792  335896    5.52 0.00536 **
## CEF:LEAYRS    2  150857   75428    1.24 0.29382
## CEF:HRSD      2   59207   29603    0.49 0.61605
## CEF:RPV       2 1106345  553173    9.10 0.00024 ***
## CEF:AMGE      2   38479   19239    0.32 0.72951
## CEF:AMSP      2  671212  335606    5.52 0.00538 **
## CEF:type      2  215319  107660    1.77 0.17574
## SRRC:PRE      1 1157204 1157204   19.03 3.2e-05 ***
## SRRC:POST1    1   64692   64692    1.06 0.30491
## SRRC:POST2    1  290645  290645    4.78 0.03122 *
## SRRC:STAY     1    7600    7600    0.13 0.72445
## SRRC:LEAYRS   1  334835  334835    5.51 0.02100 *
## SRRC:HRSD     1    2557    2557    0.04 0.83796
## SRRC:RPV      1    5179    5179    0.09 0.77102
## SRRC:AMGE     1   17274   17274    0.28 0.59526
## SRRC:AMSP     1    2207    2207    0.04 0.84931
## SRRC:type     1   96172   96172    1.58 0.21157
## PRE:POST1     1   77094   77094    1.27 0.26296
## PRE:POST2     1   43102   43102    0.71 0.40191
## PRE:STAY      1   28034   28034    0.46 0.49876
## PRE:LEAYRS    1  165711  165711    2.73 0.10203
## PRE:HRSD      1     320     320    0.01 0.94234
## PRE:RPV       1   31042   31042    0.51 0.47664
## PRE:AMGE      1   10736   10736    0.18 0.67528
## PRE:AMSP      1  331285  331285    5.45 0.02167 *
## PRE:type      1  129368  129368    2.13 0.14792
## POST1:POST2   1   97859   97859    1.61 0.20764
## POST1:STAY    1   24292   24292    0.40 0.52884
## POST1:LEAYRS  1  135378  135378    2.23 0.13894
## POST1:HRSD    1  117817  117817    1.94 0.16713
## POST1:RPV     1  350577  350577    5.77 0.01827 *
## POST1:AMGE    1    4033    4033    0.07 0.79732
## POST1:AMSP    1   89694   89694    1.48 0.22751
```

```
## POST1:type    1  220353  220353    3.62 0.05994 .
## POST2:STAY    1   65895   65895    1.08 0.30048
## POST2:LEAYRS  1   53697   53697    0.88 0.34970
## POST2:HRSD    1   59612   59612    0.98 0.32459
## POST2:RPV     1  230449  230449    3.79 0.05448 .
## POST2:AMGE    1  303326  303326    4.99 0.02784 *
## POST2:AMSP    1    1014    1014    0.02 0.89751
## POST2:type    1  217054  217054    3.57 0.06186 .
## STAY:LEAYRS   1  121407  121407    2.00 0.16087
## STAY:HRSD     1   10517   10517    0.17 0.67842
## STAY:RPV      1  322767  322767    5.31 0.02338 *
## STAY:AMGE     1     858     858    0.01 0.90570
## STAY:AMSP     1   40093   40093    0.66 0.41878
## STAY:type     1    9836    9836    0.16 0.68843
## LEAYRS:HRSD   1   12435   12435    0.20 0.65212
## LEAYRS:RPV    1   65892   65892    1.08 0.30049
## LEAYRS:AMGE   1   16359   16359    0.27 0.60517
## LEAYRS:AMSP   1     214     214    0.00 0.95278
## LEAYRS:type   1   96902   96902    1.59 0.20986
## HRSD:RPV      1  193180  193180    3.18 0.07784 .
## HRSD:type     1    6554    6554    0.11 0.74339
## RPV:type      1   16112   16112    0.26 0.60790
## AMGE:type     1   65000   65000    1.07 0.30376
## AMSP:type     1       1       1    0.00 0.99723
## Residuals    96 5837059   60803
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

We apply stepwise model search procedure:

```
model.stp<-stepAIC(aov(data=D1,time~.^2),scope=list(upper=~.^2,lower=~1),
                   direction="backward",trace=FALSE)
print(model.stp$anova,signif.stars=TRUE)
```

```
## Stepwise Model Path
## Analysis of Deviance Table
##
## Initial Model:
## time ~ (Hand + EO + List + CEF + SRRC + PRE + POST1 + POST2 +
##     STAY + LEAYRS + HRSD + RPV + AMGE + AMSP + type)^2
##
## Final Model:
## time ~ Hand + EO + List + CEF + SRRC + PRE + POST1 + POST2 +
##     STAY + LEAYRS + HRSD + RPV + AMGE + AMSP + type + Hand:EO +
##     Hand:List + Hand:CEF + Hand:SRRC + Hand:PRE + Hand:POST1 +
##     Hand:POST2 + Hand:STAY + Hand:LEAYRS + Hand:HRSD + Hand:RPV +
##     Hand:AMGE + Hand:type + EO:CEF + EO:SRRC + EO:PRE + EO:POST1 +
##     EO:POST2 + EO:STAY + EO:LEAYRS + EO:HRSD + EO:RPV + EO:AMGE +
##     EO:type + List:CEF + List:SRRC + List:PRE + List:POST1 +
##     List:POST2 + List:LEAYRS + List:HRSD + List:RPV + List:AMGE +
##     List:type + CEF:SRRC + CEF:PRE + CEF:POST1 + CEF:POST2 +
##     CEF:STAY + CEF:LEAYRS + CEF:RPV + CEF:AMGE + CEF:AMSP + CEF:type +
##     SRRC:PRE + SRRC:POST1 + SRRC:POST2 + SRRC:STAY + SRRC:RPV +
```

```
##     SRRC:AMGE + SRRC:AMSP + SRRC:type + PRE:POST1 + PRE:POST2 +
##     PRE:STAY + PRE:LEAYRS + PRE:RPV + PRE:AMGE + PRE:AMSP + PRE:type +
##     POST1:STAY + POST1:LEAYRS + POST1:RPV + POST1:AMGE + POST1:AMSP +
##     POST1:type + POST2:LEAYRS + POST2:HRSD + POST2:RPV + POST2:AMGE +
##     POST2:AMSP + POST2:type + STAY:LEAYRS + STAY:HRSD + STAY:AMGE +
##     STAY:AMSP + LEAYRS:HRSD + LEAYRS:RPV + LEAYRS:type + HRSD:RPV +
##     AMGE:type
##
##
##              Step Df   Deviance Resid. Df Resid. Dev    AIC
## 1                                     96    5837059 2544.8
## 2    - AMGE:AMSP  0 0.0000e+00        96    5837059 2544.8
## 3     - RPV:AMSP  0 0.0000e+00        96    5837059 2544.8
## 4     - RPV:AMGE  0 0.0000e+00        96    5837059 2544.8
## 5    - HRSD:AMSP  0 0.0000e+00        96    5837059 2544.8
## 6    - HRSD:AMGE  0 0.0000e+00        96    5837059 2544.8
## 7      - EO:List  0 0.0000e+00        96    5837059 2544.8
## 8    - Hand:AMSP  0 0.0000e+00        96    5837059 2544.8
## 9     - CEF:HRSD  2 2.7151e+04        98    5864210 2541.9
## 10   - AMSP:type  1 5.5764e-01        99    5864211 2539.9
## 11   - List:STAY  1 1.4166e+01       100    5864225 2537.9
## 12 - SRRC:LEAYRS  1 5.4747e+01       101    5864280 2535.9
## 13 - POST1:POST2  1 2.9828e+02       102    5864578 2533.9
## 14   - SRRC:HRSD  1 9.9786e+02       103    5865576 2531.9
## 15 - LEAYRS:AMSP  1 1.2108e+03       104    5866787 2530.0
## 16    - STAY:RPV  1 1.0270e+03       105    5867814 2528.0
## 17   - List:AMSP  1 1.7169e+03       106    5869530 2526.1
## 18 - LEAYRS:AMGE  1 3.5102e+03       107    5873041 2524.2
## 19   - HRSD:type  1 4.1547e+03       108    5877195 2522.4
## 20     - EO:AMSP  1 6.3528e+03       109    5883548 2520.6
## 21    - RPV:type  1 1.3301e+04       110    5896850 2519.1
## 22   - STAY:type  1 2.4328e+04       111    5921177 2518.0
## 23  - POST2:STAY  1 3.1085e+04       112    5952263 2517.2
## 24  - POST1:HRSD  1 1.2135e+04       113    5964397 2515.7
## 25    - PRE:HRSD  1 1.0073e+04       114    5974470 2514.1
```

```
m2b<-lm(data=D1,time ~ Hand + EO + List + CEF + SRRC + PRE + POST1 + POST2 +
STAY + LEAYRS + HRSD + RPV + AMGE + AMSP + type + Hand:EO +
Hand:CEF + Hand:SRRC + Hand:PRE + Hand:POST1 + Hand:STAY +
Hand:LEAYRS + Hand:HRSD + Hand:RPV + Hand:AMGE + Hand:type +
EO:CEF + EO:SRRC + EO:PRE + EO:POST1 + EO:POST2 + EO:STAY +
EO:LEAYRS + EO:HRSD + EO:AMGE + EO:type + List:CEF + List:SRRC +
List:PRE + List:POST1 + List:POST2 + List:STAY + List:HRSD +
List:type + CEF:SRRC + CEF:PRE + CEF:POST1 + CEF:POST2 +
CEF:STAY + CEF:LEAYRS + CEF:RPV + CEF:AMGE + CEF:AMSP + CEF:type +
SRRC:POST1 + SRRC:POST2 + SRRC:STAY + SRRC:LEAYRS + SRRC:HRSD +
SRRC:RPV + SRRC:AMGE + SRRC:type + PRE:POST2 + PRE:STAY +
PRE:LEAYRS + PRE:HRSD + PRE:AMGE + PRE:type + POST1:POST2 +
POST1:STAY + POST1:LEAYRS + POST1:HRSD + POST1:RPV + POST1:AMGE +
POST1:type + POST2:STAY + POST2:LEAYRS + POST2:HRSD + POST2:RPV +
POST2:AMGE + POST2:type + STAY:LEAYRS + STAY:HRSD + STAY:RPV +
LEAYRS:type)
print(anova(m2b),signif.stars = TRUE)
```

```
## Analysis of Variance Table
##
## Response: time
##               Df  Sum Sq Mean Sq F value  Pr(>F)
## Hand           1 1566311 1566311   22.50 5.6e-06 ***
## EO             1  406132  406132    5.83 0.01716 *
## List           1   32646   32646    0.47 0.49472
## CEF            2  311627  155814    2.24 0.11089
## SRRC           1   48892   48892    0.70 0.40358
## PRE            1  176563  176563    2.54 0.11377
## POST1          1 1753898 1753898   25.20 1.7e-06 ***
## POST2          1  470449  470449    6.76 0.01045 *
## STAY           1    1062    1062    0.02 0.90191
## LEAYRS         1  895489  895489   12.86 0.00048 ***
## HRSD           1  306396  306396    4.40 0.03792 *
## RPV            1   28814   28814    0.41 0.52116
## AMGE           1       4       4    0.00 0.99417
## AMSP           1  144975  144975    2.08 0.15148
## type           1    5742    5742    0.08 0.77444
## Hand:EO        1   62203   62203    0.89 0.34633
## Hand:CEF       2  279982  139991    2.01 0.13815
## Hand:SRRC      1  150320  150320    2.16 0.14421
## Hand:PRE       1   17623   17623    0.25 0.61574
## Hand:POST1     1  154163  154163    2.21 0.13922
## Hand:STAY      1  208441  208441    2.99 0.08602 .
## Hand:LEAYRS    1  364735  364735    5.24 0.02375 *
## Hand:HRSD      1   72266   72266    1.04 0.31022
## Hand:RPV       1 1015772 1015772   14.59 0.00021 ***
## Hand:AMGE      1    1837    1837    0.03 0.87120
## Hand:type      1  311975  311975    4.48 0.03624 *
## EO:CEF         2  120851   60425    0.87 0.42228
## EO:SRRC        1   11305   11305    0.16 0.68764
## EO:PRE         1    3962    3962    0.06 0.81183
## EO:POST1       1  467863  467863    6.72 0.01066 *
## EO:POST2       1   34680   34680    0.50 0.48160
## EO:STAY        1  191073  191073    2.74 0.10007
## EO:LEAYRS      1  485556  485556    6.98 0.00932 **
## EO:HRSD        1    2728    2728    0.04 0.84340
## EO:AMGE        1   21913   21913    0.31 0.57576
## EO:type        1   63505   63505    0.91 0.34135
## List:CEF       2  350773  175386    2.52 0.08457 .
## List:SRRC      1   51581   51581    0.74 0.39099
## List:PRE       1    5026    5026    0.07 0.78860
## List:POST1     1 1084053 1084053   15.57 0.00013 ***
## List:POST2     1  331803  331803    4.77 0.03088 *
## List:STAY      1  312961  312961    4.50 0.03595 *
## List:HRSD      1    9329    9329    0.13 0.71492
## List:type      1  736773  736773   10.58 0.00147 **
## CEF:SRRC       2  354601  177300    2.55 0.08237 .
## CEF:PRE        2  281236  140618    2.02 0.13695
## CEF:POST1      2   57897   28948    0.42 0.66068
## CEF:POST2      2 1043147  521573    7.49 0.00084 ***
## CEF:STAY       2  330525  165263    2.37 0.09728 .
## CEF:LEAYRS     2  273156  136578    1.96 0.14487
```

```
## CEF:RPV        2 1072504  536252    7.70 0.00070 ***
## CEF:AMGE       2     562     281    0.00 0.99597
## CEF:AMSP       2  593035  296517    4.26 0.01623 *
## CEF:type       2  217167  108583    1.56 0.21422
## SRRC:POST1     1  420244  420244    6.04 0.01538 *
## SRRC:POST2     1  383636  383636    5.51 0.02047 *
## SRRC:STAY      1   18307   18307    0.26 0.60898
## SRRC:LEAYRS    1  330355  330355    4.75 0.03125 *
## SRRC:HRSD      1   97668   97668    1.40 0.23845
## SRRC:RPV       1    1388    1388    0.02 0.88794
## SRRC:AMGE      1  117783  117783    1.69 0.19572
## SRRC:type      1  113584  113584    1.63 0.20383
## PRE:POST2      1   24220   24220    0.35 0.55635
## PRE:STAY       1    1475    1475    0.02 0.88449
## PRE:LEAYRS     1   29851   29851    0.43 0.51377
## PRE:HRSD       1      56      56    0.00 0.97735
## PRE:AMGE       1   44756   44756    0.64 0.42416
## PRE:type       1  134437  134437    1.93 0.16709
## POST1:POST2    1   19145   19145    0.28 0.60090
## POST1:STAY     1  276946  276946    3.98 0.04826 *
## POST1:LEAYRS   1   94259   94259    1.35 0.24678
## POST1:HRSD     1   11869   11869    0.17 0.68037
## POST1:RPV      1   27164   27164    0.39 0.53331
## POST1:AMGE     1  125557  125557    1.80 0.18169
## POST1:type     1  234133  234133    3.36 0.06903 .
## POST2:STAY     1   33267   33267    0.48 0.49065
## POST2:LEAYRS   1   17729   17729    0.25 0.61468
## POST2:HRSD     1  847616  847616   12.18 0.00067 ***
## POST2:RPV      1   32018   32018    0.46 0.49889
## POST2:AMGE     1  846967  846967   12.17 0.00067 ***
## POST2:type     1  214989  214989    3.09 0.08130 .
## STAY:LEAYRS    1  363454  363454    5.22 0.02400 *
## STAY:HRSD      1   13285   13285    0.19 0.66296
## STAY:RPV       1   19385   19385    0.28 0.59863
## LEAYRS:type    1   91179   91179    1.31 0.25461
## Residuals    125 8701170   69609
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

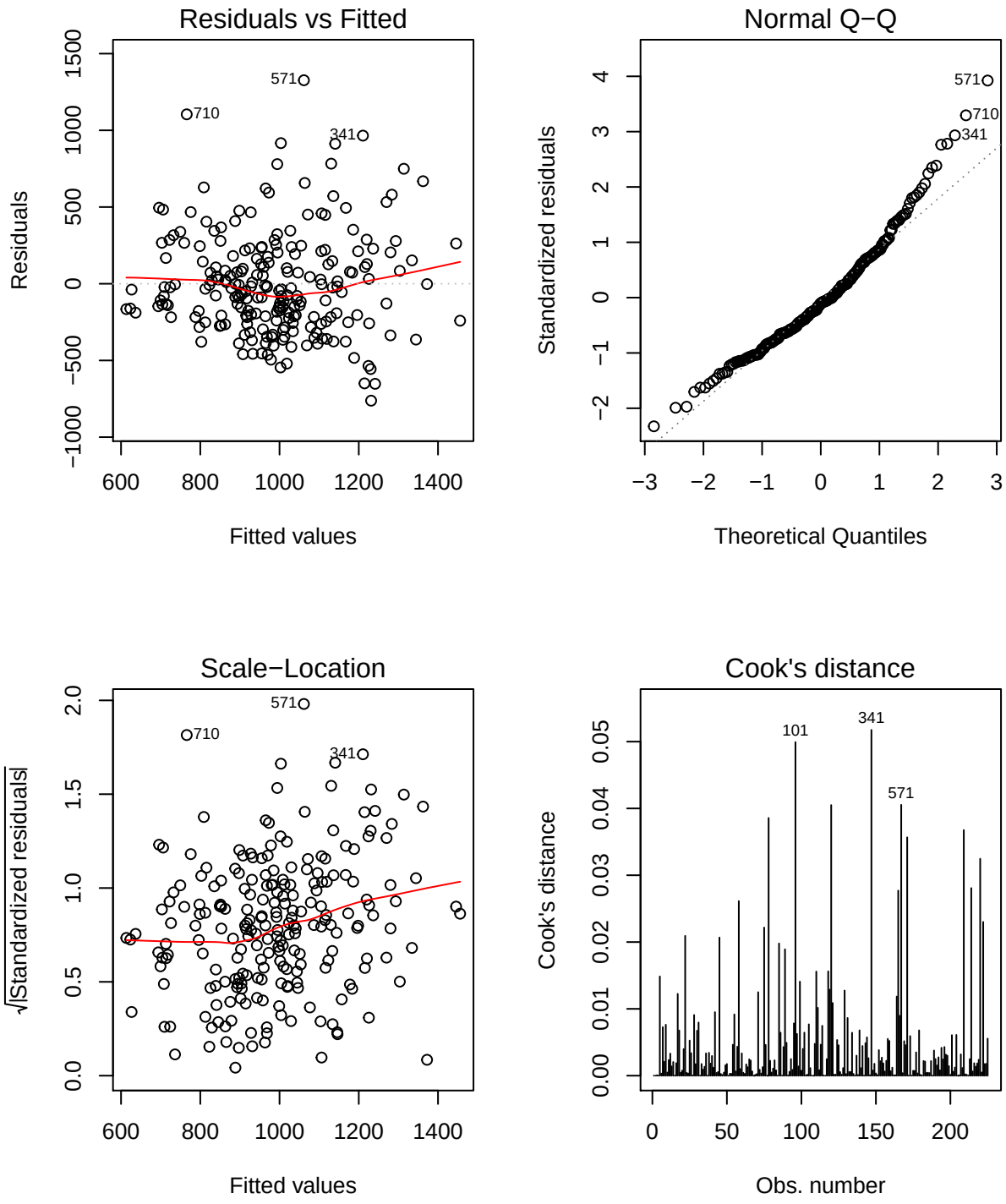
```
anova(m2b,m2)
```

```
## Analysis of Variance Table
##
## Model 1: time ~ Hand + EO + List + CEF + SRRC + PRE + POST1 + POST2 +
##     STAY + LEAYRS + HRSD + RPV + AMGE + AMSP + type + Hand:EO +
##     Hand:CEF + Hand:SRRC + Hand:PRE + Hand:POST1 + Hand:STAY +
##     Hand:LEAYRS + Hand:HRSD + Hand:RPV + Hand:AMGE + Hand:type +
##     EO:CEF + EO:SRRC + EO:PRE + EO:POST1 + EO:POST2 + EO:STAY +
##     EO:LEAYRS + EO:HRSD + EO:AMGE + EO:type + List:CEF + List:SRRC +
##     List:PRE + List:POST1 + List:POST2 + List:STAY + List:HRSD +
##     List:type + CEF:SRRC + CEF:PRE + CEF:POST1 + CEF:POST2 +
##     CEF:STAY + CEF:LEAYRS + CEF:RPV + CEF:AMGE + CEF:AMSP + CEF:type +
##     SRRC:POST1 + SRRC:POST2 + SRRC:STAY + SRRC:LEAYRS + SRRC:HRSD +
##     SRRC:RPV + SRRC:AMGE + SRRC:type + PRE:POST2 + PRE:STAY +
```

```
##     PRE:LEAYRS + PRE:HRSD + PRE:AMGE + PRE:type + POST1:POST2 +
##     POST1:STAY + POST1:LEAYRS + POST1:HRSD + POST1:RPV + POST1:AMGE +
##     POST1:type + POST2:STAY + POST2:LEAYRS + POST2:HRSD + POST2:RPV +
##     POST2:AMGE + POST2:type + STAY:LEAYRS + STAY:HRSD + STAY:RPV +
##     LEAYRS:type
## Model 2: time ~ (Hand + EO + List + CEF + SRRC + PRE + POST1 + POST2 +
##     STAY + LEAYRS + HRSD + RPV + AMGE + AMSP + type)^2
##   Res.Df     RSS Df Sum of Sq    F Pr(>F)
## 1    125 8701170
## 2     96 5837059 29   2864111 1.62  0.042 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Diagnostic plots

```
par(mfrow=c(2,2))
plot(m,which=1:4)
```



From the qplot we see that the point 1071 is an outlier: With hindsight we already remove it above. Afterwards the qqplot looks perfectly normal.

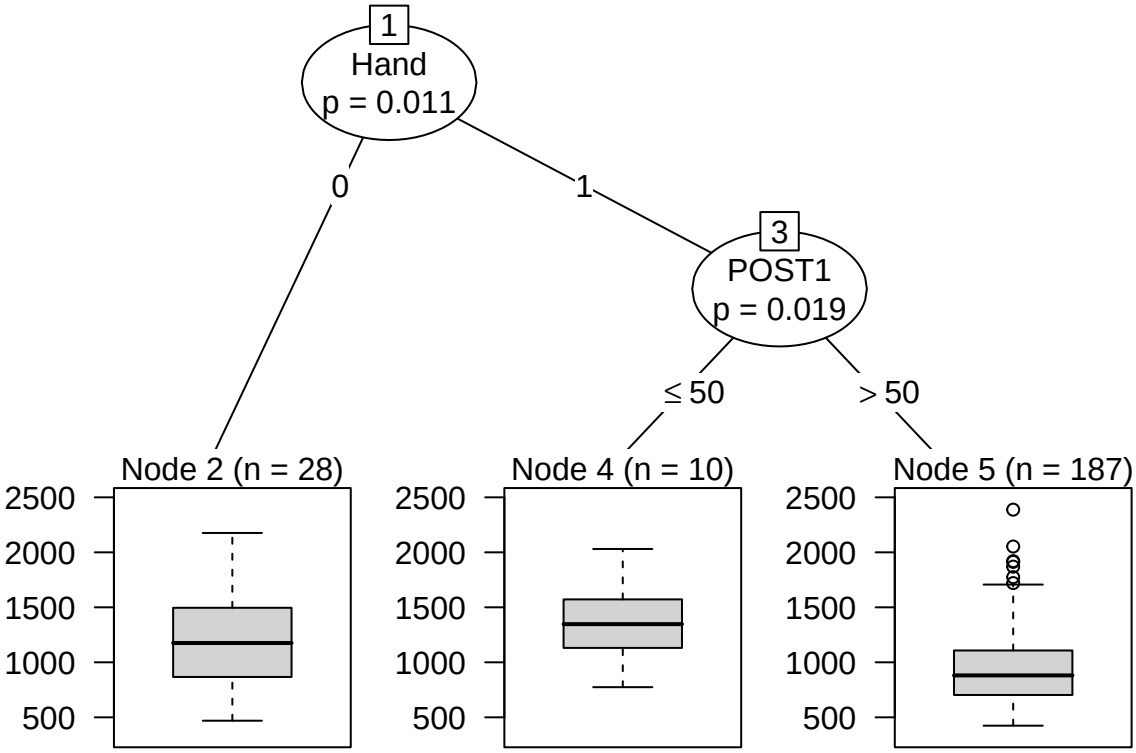
Regression tree

Another type of analysis by means of regression tree:

```
ct <- ctree(data=D1,time~.^2)
ct
```

```
##
##   Conditional inference tree with 3 terminal nodes
##
## Response:  time
## Inputs:  Hand, EO, List, CEF, SRRC, PRE, POST1, POST2, STAY, LEAYRS, HRSD, RPV, AMGE, AMSP, type
## Number of observations:  225
##
## 1) Hand == {0}; criterion = 0.989, statistic = 11.323
##   2)*  weights = 28
## 1) Hand == {1}
##   3) POST1 <= 50; criterion = 0.981, statistic = 10.423
##     4)*  weights = 10
##   3) POST1 > 50
##     5)*  weights = 187
```

```
plot(ct)
```

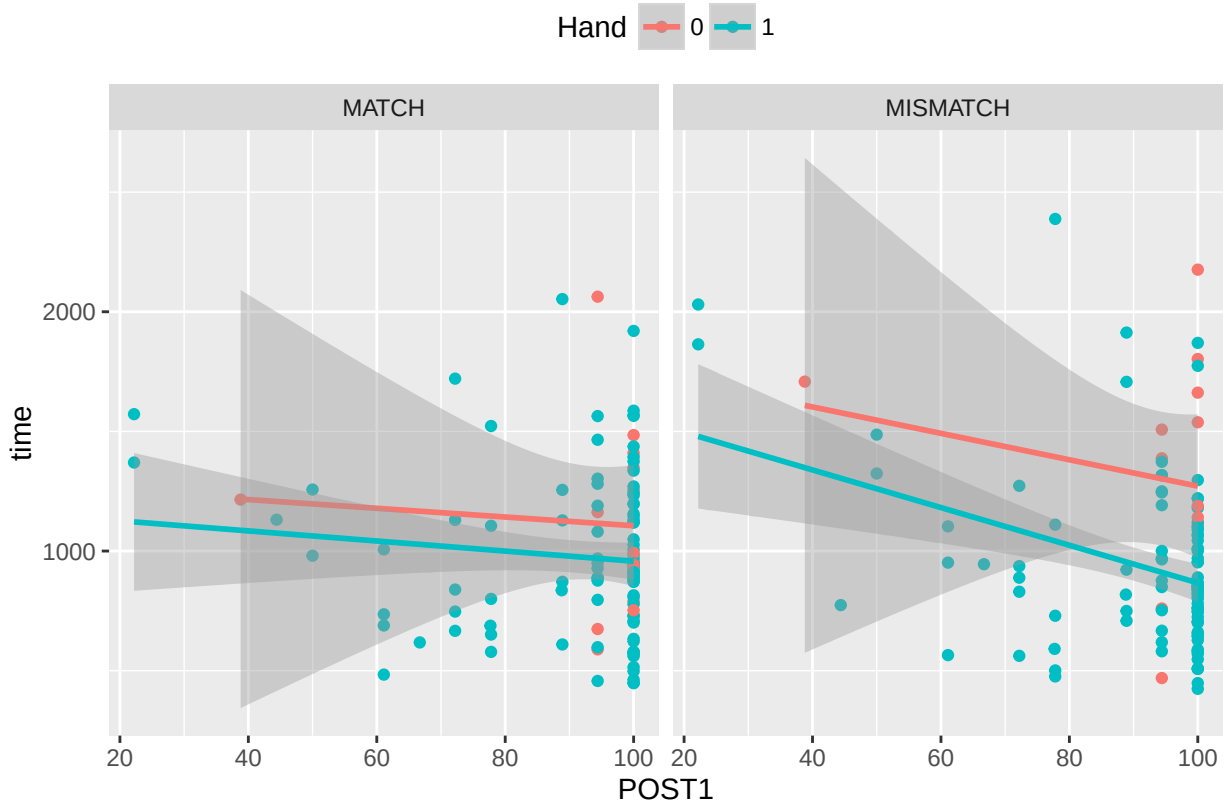


From the plot we understand that regression trees find only two factors POST1 and Hand and their interaction as relevant expalin differences in the response time.

Data visualization

We visualize the influence of the two factors that have been found explaning the most the reponse time. We separate the plots in match and mismatch cases, although this factor was found not to be important.

```
q<-ggplot(data=D1,aes(y=time,x=POST1,color=Hand))
q<-q+facet_grid(.~type)
q<-q+geom_point()
q<-q+geom_smooth(method=lm)
q<-q+theme(legend.position="top")
print(q)
```



We shall conclude that the response time depends on the hand and on the general proficency in the verbs as assessed by the POST1 test. Right handed subjects with good performance in the POST1 test respond faster.