latticeExtra_examples.R

georges

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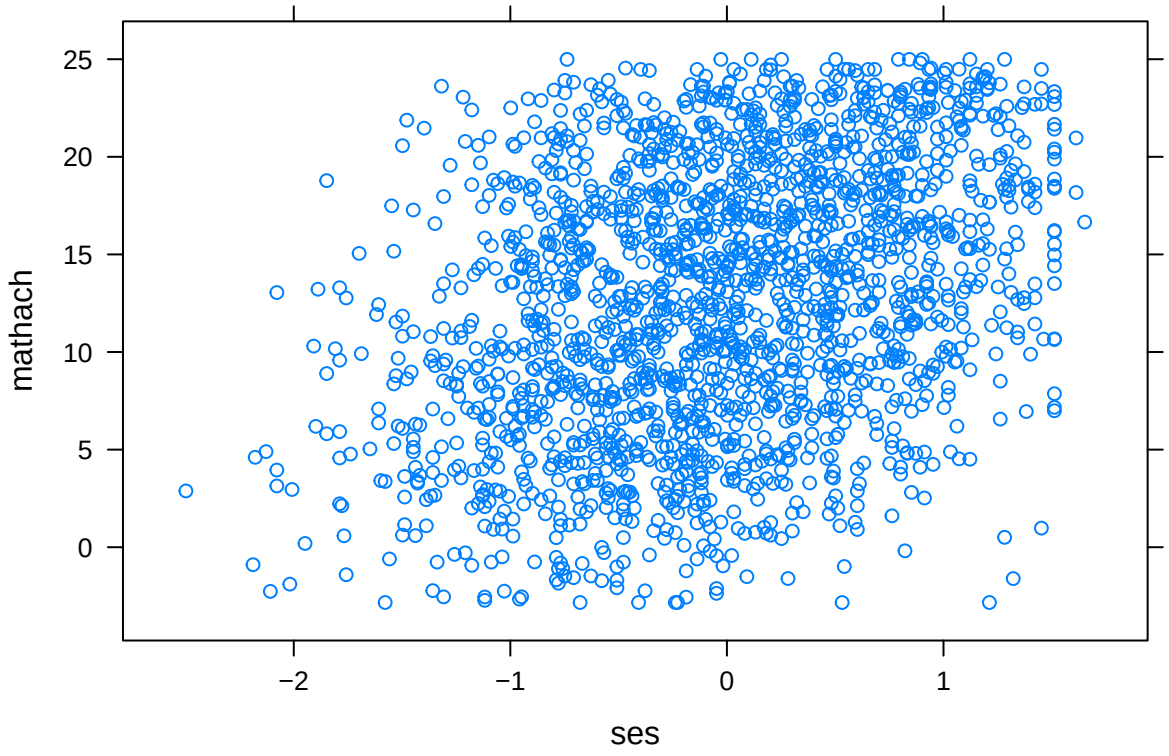
Some references for the lattice package:

- Advanced graphics with the lattice package - R in Action, Second Edition: Data analysis and graphics with R

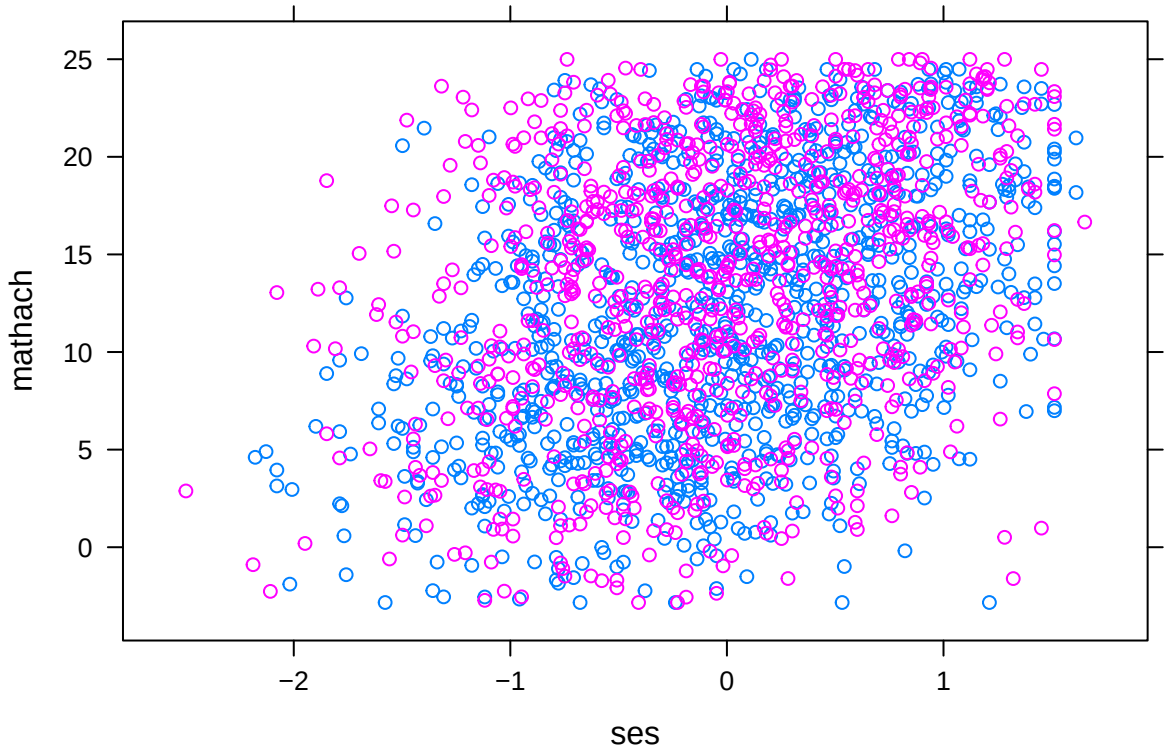
```
library(spida2)
library(lattice)
library(latticeExtra)

head(hs)
```

```
##   school mathach    ses    Sex Minority Size   Sector PRACAD DISCLIM
## 1   1317  12.862  0.882 Female       No  455 Catholic   0.95  -1.694
## 2   1317   8.961  0.932 Female      Yes  455 Catholic   0.95  -1.694
## 3   1317   4.756 -0.158 Female      Yes  455 Catholic   0.95  -1.694
## 4   1317  21.405  0.362 Female      Yes  455 Catholic   0.95  -1.694
## 5   1317  20.748  1.372 Female       No  455 Catholic   0.95  -1.694
## 6   1317  18.362  0.132 Female      Yes  455 Catholic   0.95  -1.694
```

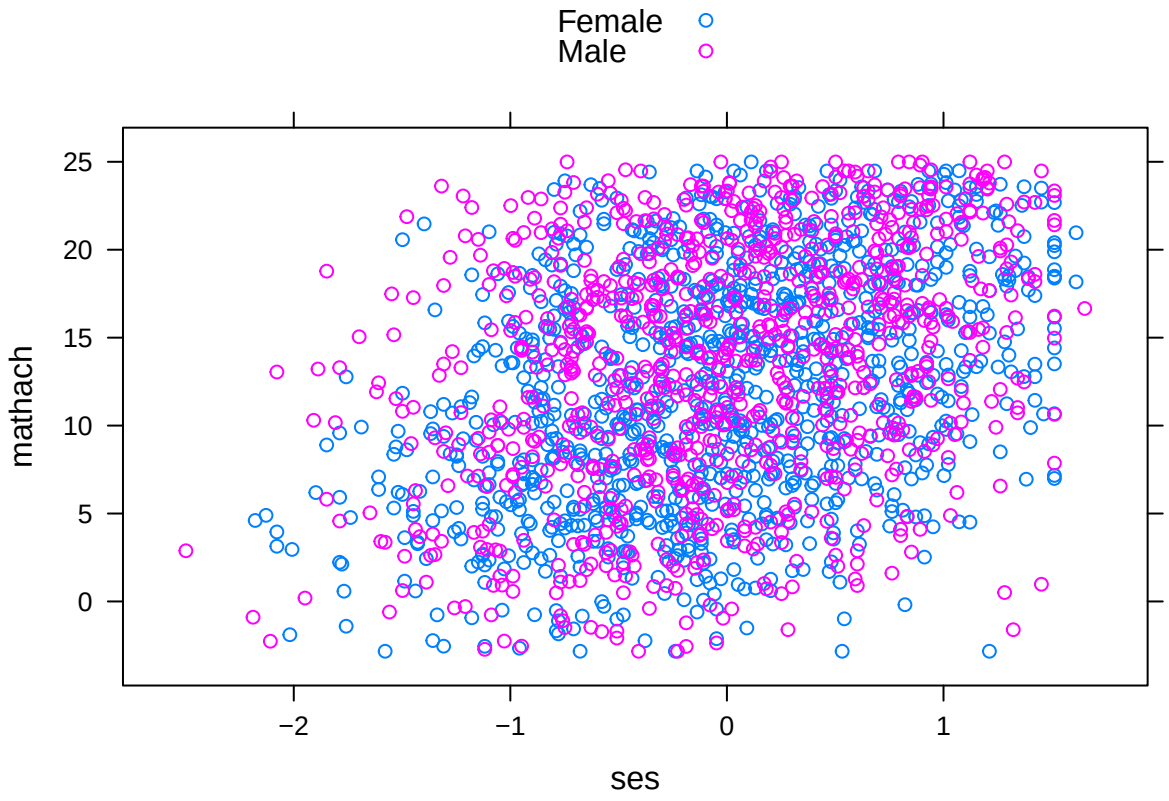
```
xyplot( mathach ~ ses, hs)
```



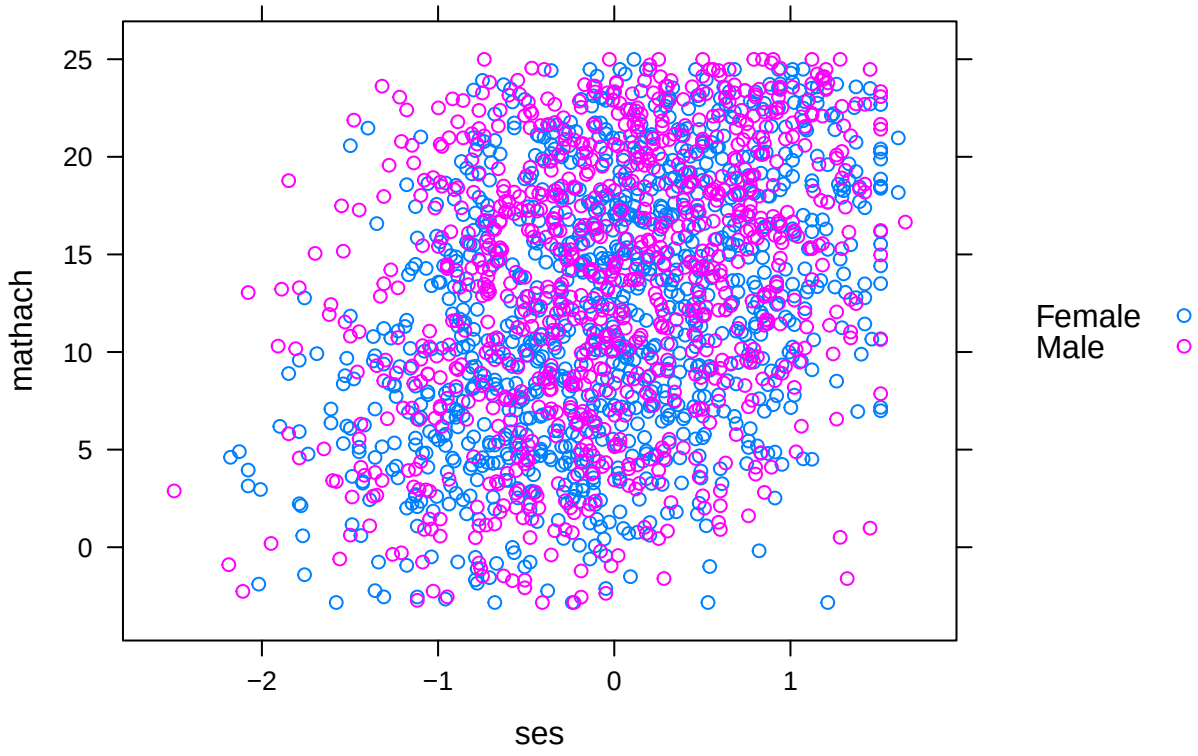

```
xyplot( mathach ~ ses, hs, groups = Sex)
```



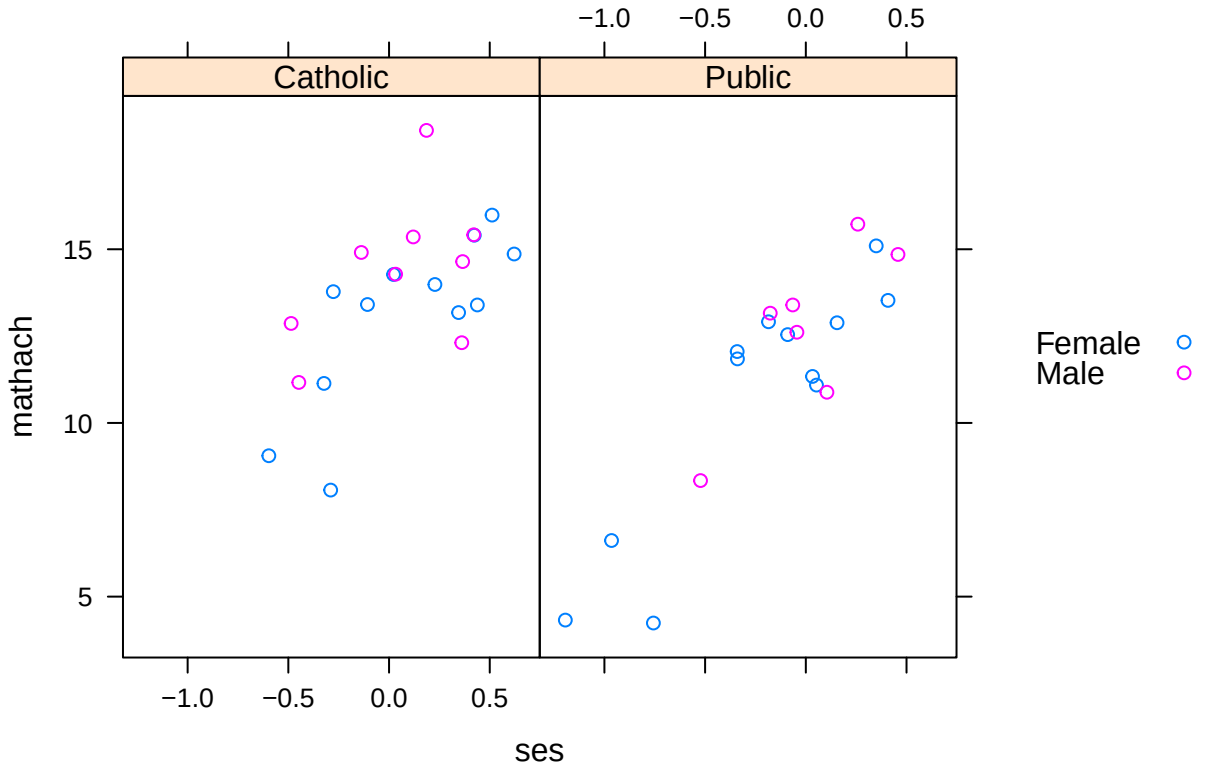

```
xyplot( mathach ~ ses, hs, groups = Sex, auto.key = T)
```



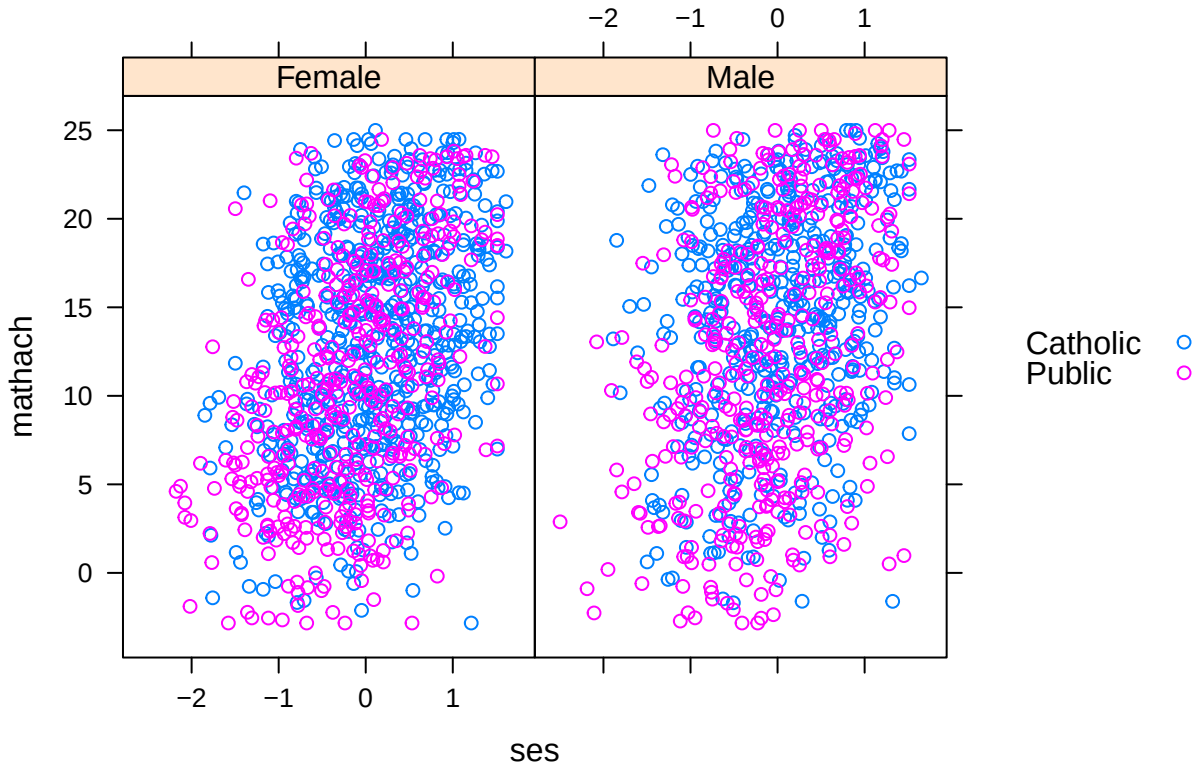

```
xyplot( mathach ~ ses, hs, groups = Sex,
        auto.key = list(space = 'right'))
```



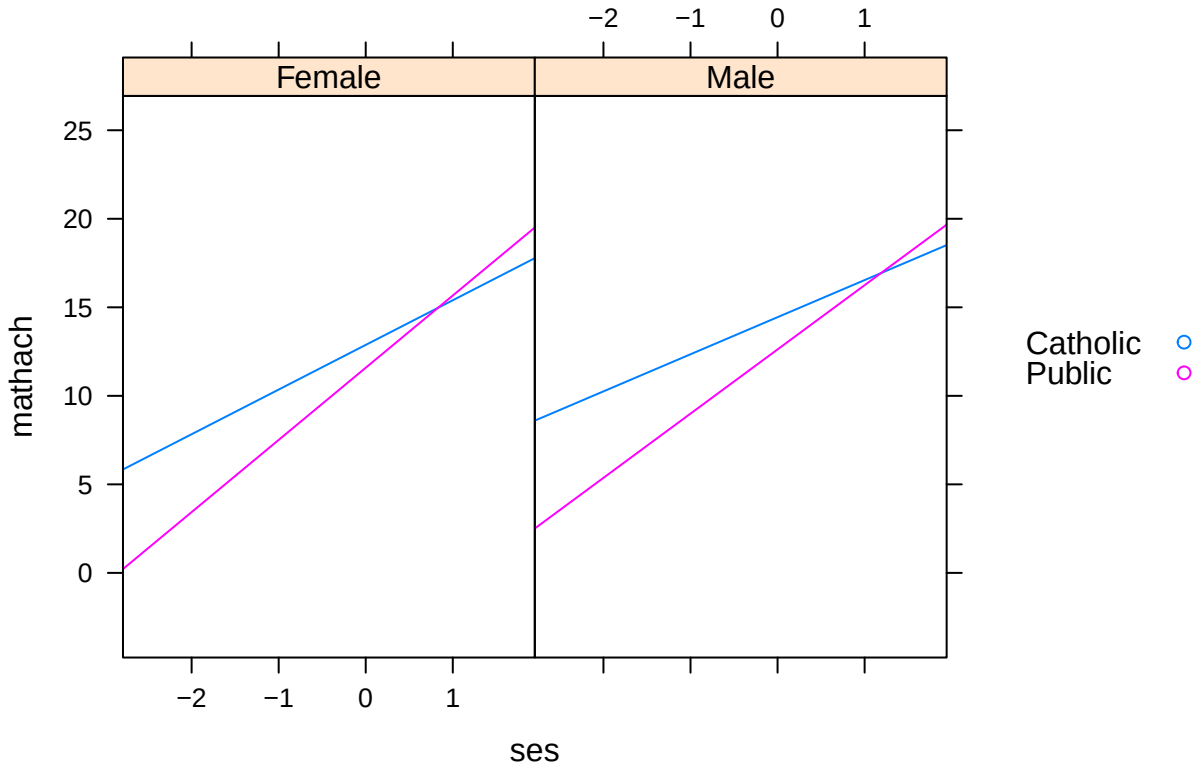

```
# exercise create a girl/boy/coed variable
xyplot( mathach ~ ses | Sector,
        up(hs, ~school, all =T), groups = Sex,
        auto.key = list(space = 'right'))
```



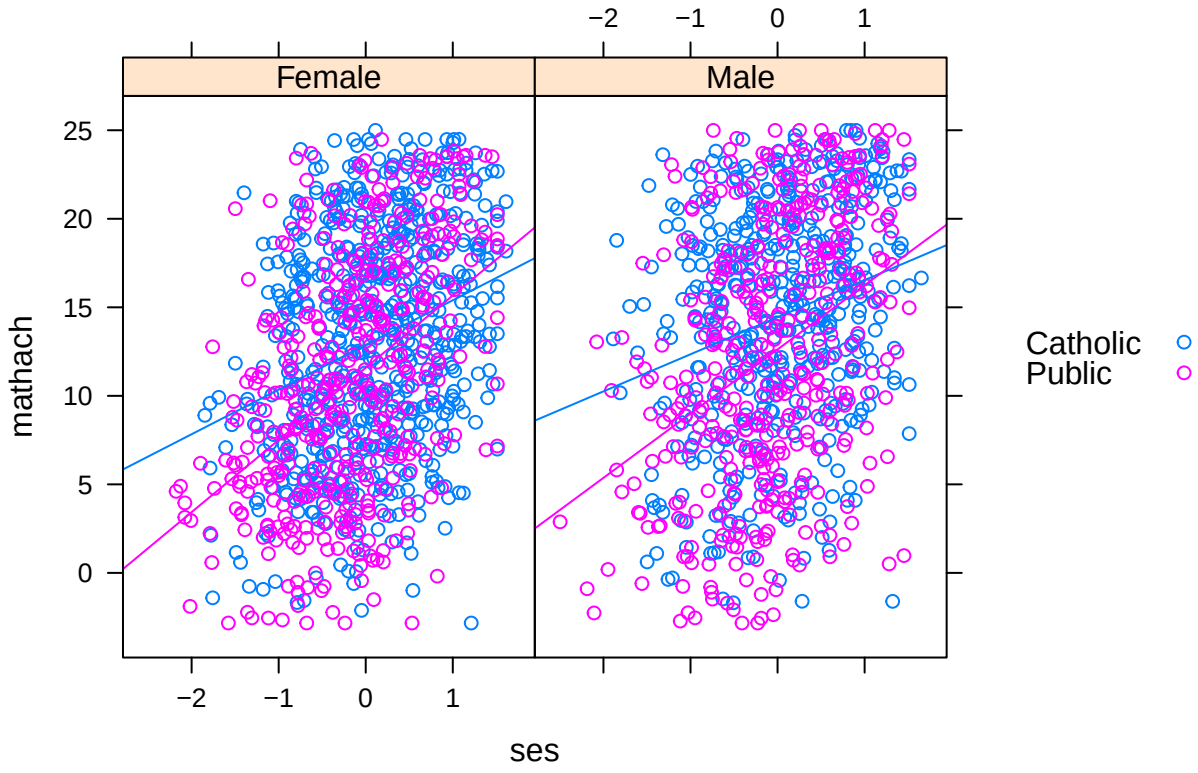

```
xyplot( mathach ~ ses | Sex, hs,
        groups = Sector, type = 'p',
        auto.key = list(space = 'right'))
```



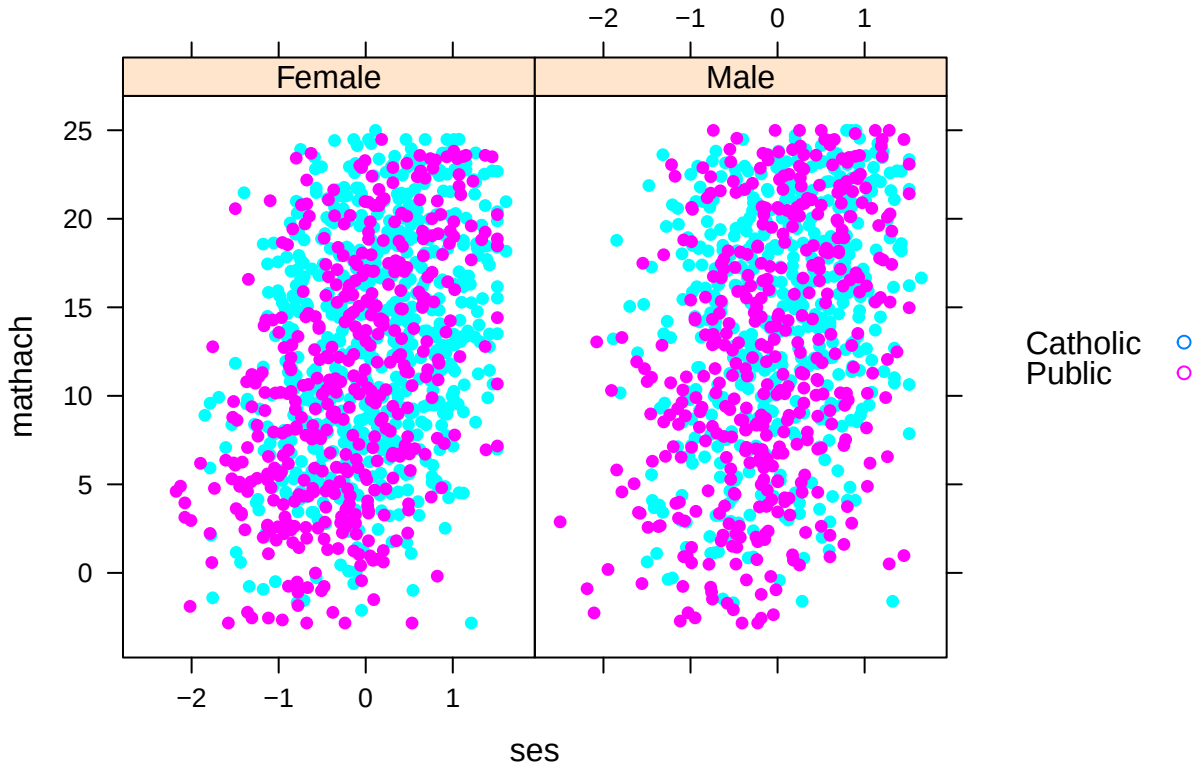

```
xyplot( mathach ~ ses | Sex, hs, groups = Sector,
        type = 'r',                                  # r for regression
        auto.key = list(space = 'right'))
```



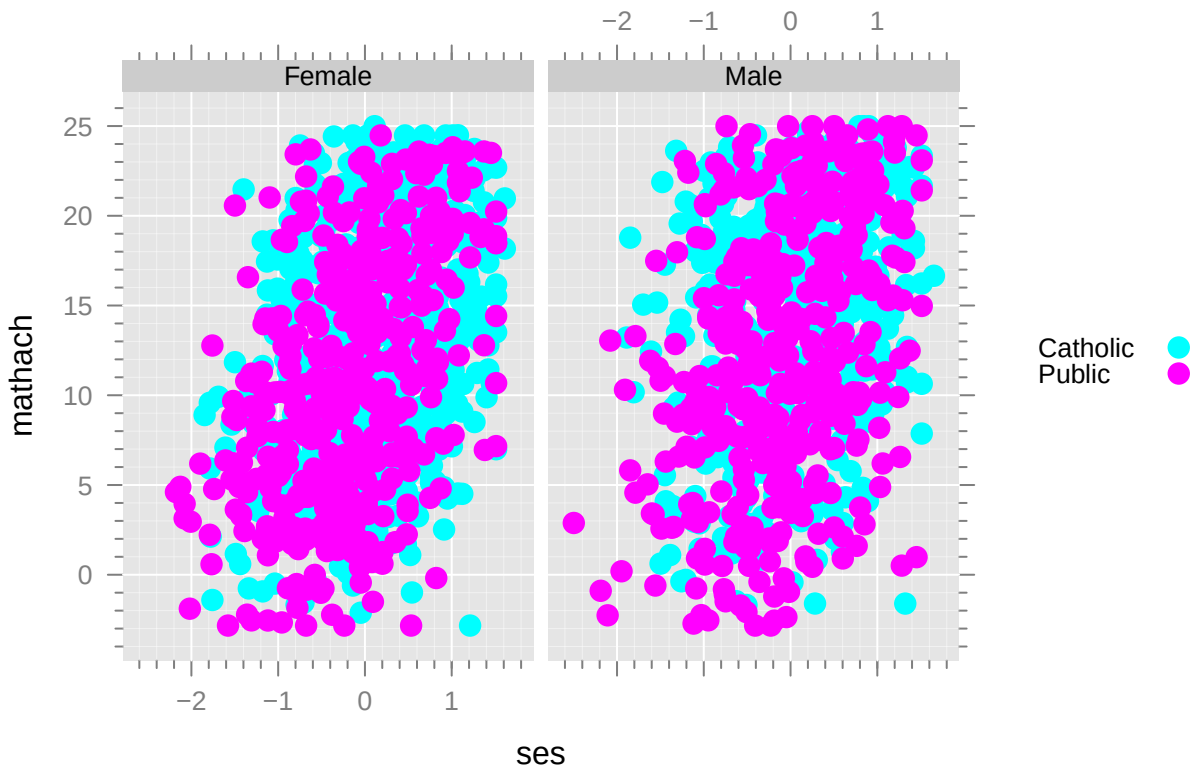

```
xyplot( mathach ~ ses | Sex, hs, groups = Sector,
        type = 'p',                                  # p for points
        auto.key = list(space = 'right'))  +    # to overlay plots
xyplot( mathach ~ ses | Sex, hs, groups = Sector,
        type = 'r',                                  # r for regression
        auto.key = list(space = 'right'))
```



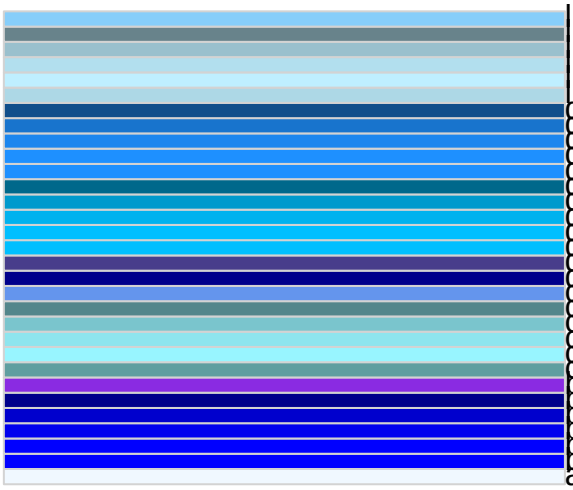

```
#
# You can change colors, etc. in xyplot but the changes won't affect auto.key
#
xyplot( mathach ~ ses | Sex, hs, groups = Sector,
        pch = 16, col = c('#00FFFFFF', '#FF00FFFF'),  # RGB + ALPHA (transparency)
        auto.key = list(space = 'right'))
```

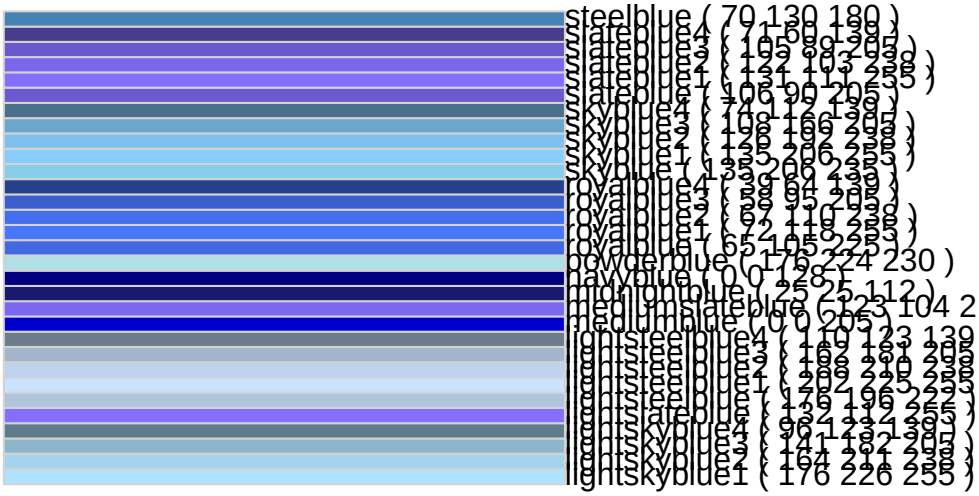


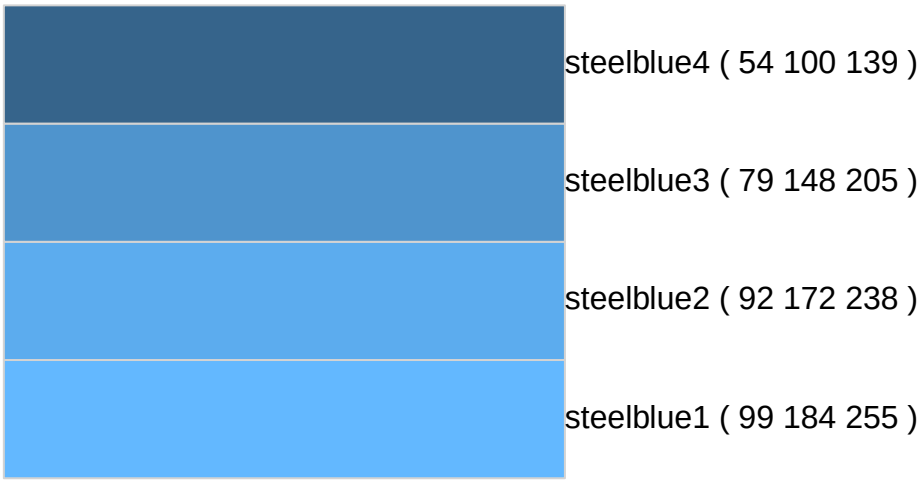

```
# td and gd: gd sets up gg-like plots,

gd( pch = 16, col = c('#00FFFFFF', '#FF00FFFF'))
p <- xyplot(
  mathach ~ ses | Sex, hs, groups = Sector,
  auto.key = list(space = 'right'))
p
```



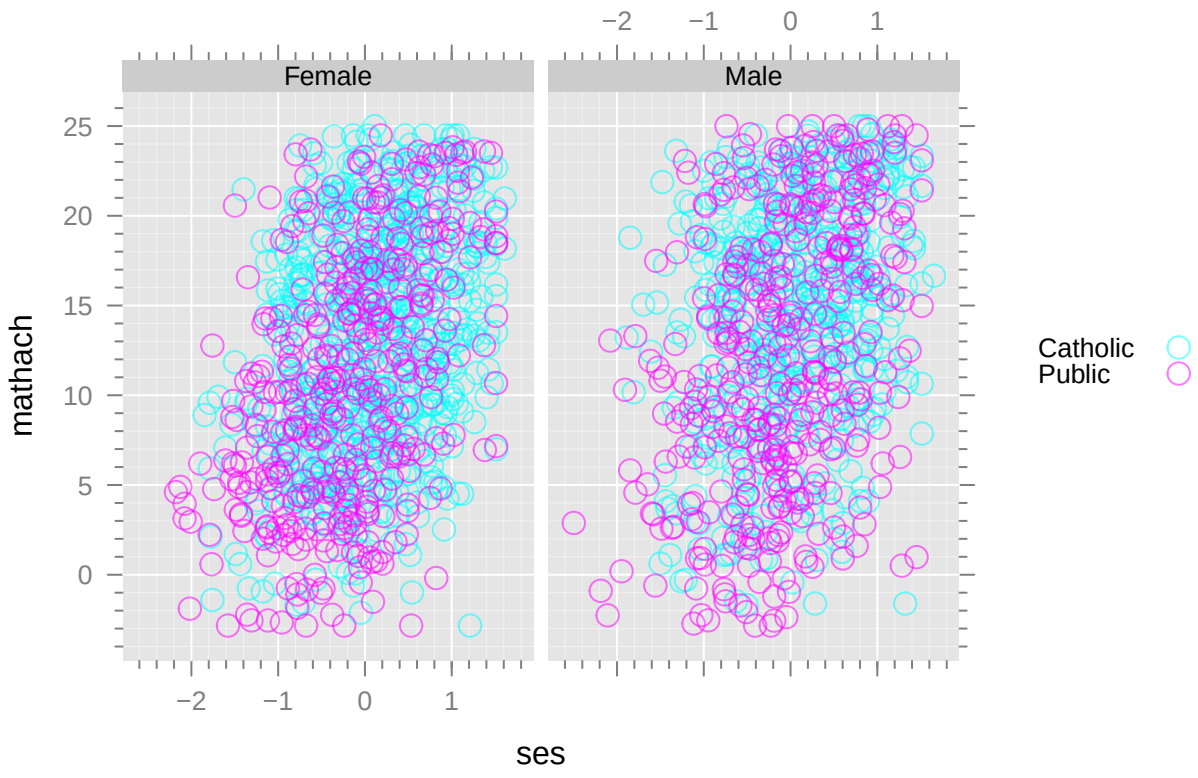

```
#
# Colors
#
pals('blue')
```


lightskyblue (135 206 250)
dodgerblue4 (16 78 139)
dodgerblue3 (24 116 205)
dodgerblue2 (28 134 238)
dodgerblue1 (30 144 255)
dodgerblue (30 144 255)
deepskyblue4 (0 104 139)
deepskyblue3 (0 154 205)
deepskyblue2 (0 178 238)
deepskyblue1 (0 191 255)
deepskyblue (0 191 255)
darkslateblue (72 61 139)
darkblue (0 0 139)
cornflowerblue (100 149 237)
cadetblue4 (83 134 139)
cadetblue3 (122 197 205)
cadetblue2 (142 229 238)
cadetblue1 (152 245 255)
cadetblue (95 158 160)
blueviolet (138 43 226)
blue4 (0 0 139)
blue3 (0 0 205)
blue2 (0 0 238)
blue1 (0 0 255)
blue (0 0 255)
aliceblue (240 248 255)

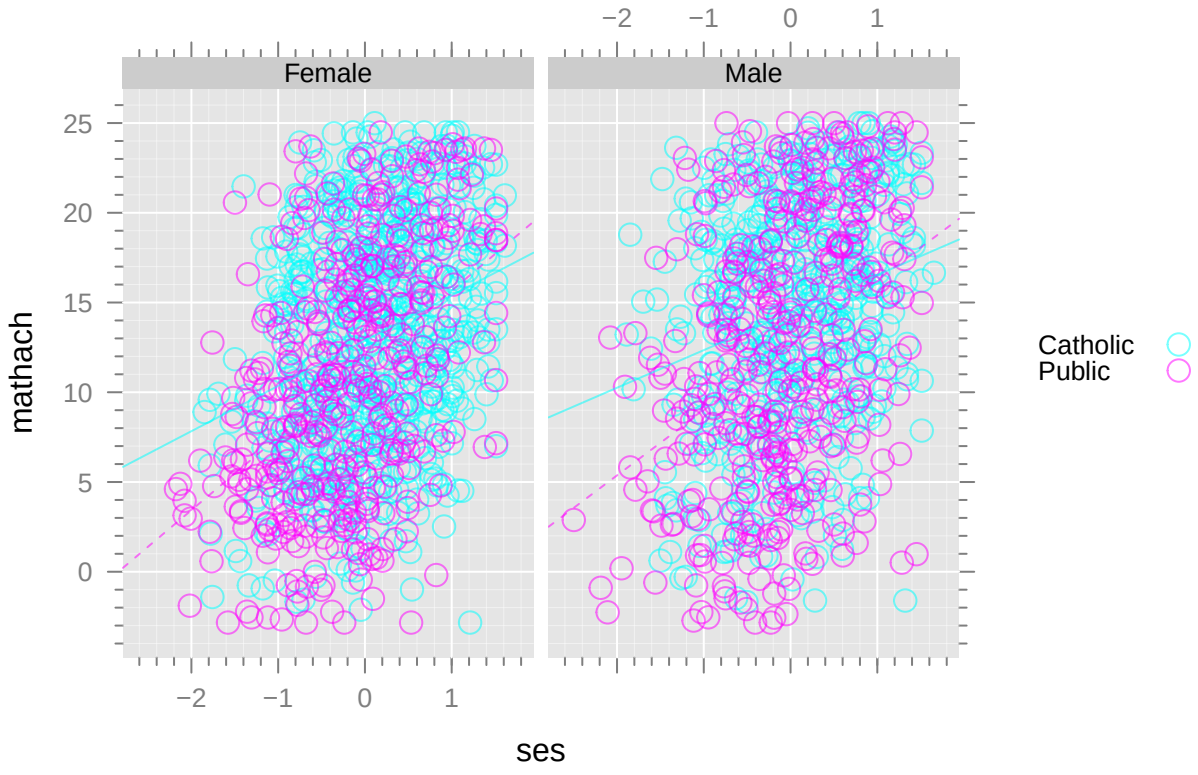

steelblue (70 130 180)
lightskyblue1 (176 226 255)



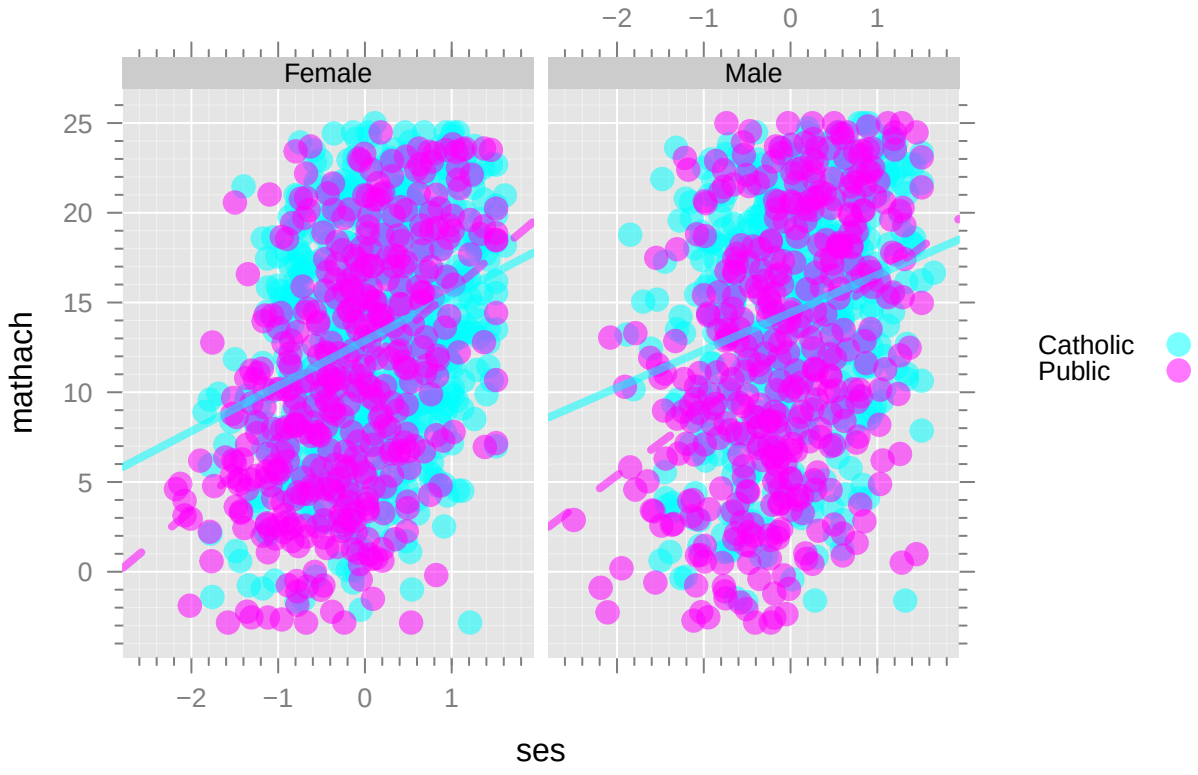

```
#
# Note that second level covers the first, which is a problem if plot is dense
#
gd( pch = 21, col = c('#00FFFF88', '#FF00FF88'))  # using transparency
p
```




```
p + glayer(panel.lmline(...))
```




```
gd(lwd = 4,  col = c('#00FFFF88', '#FF00FF88'))
p + glayer(panel.lmline(...))
```

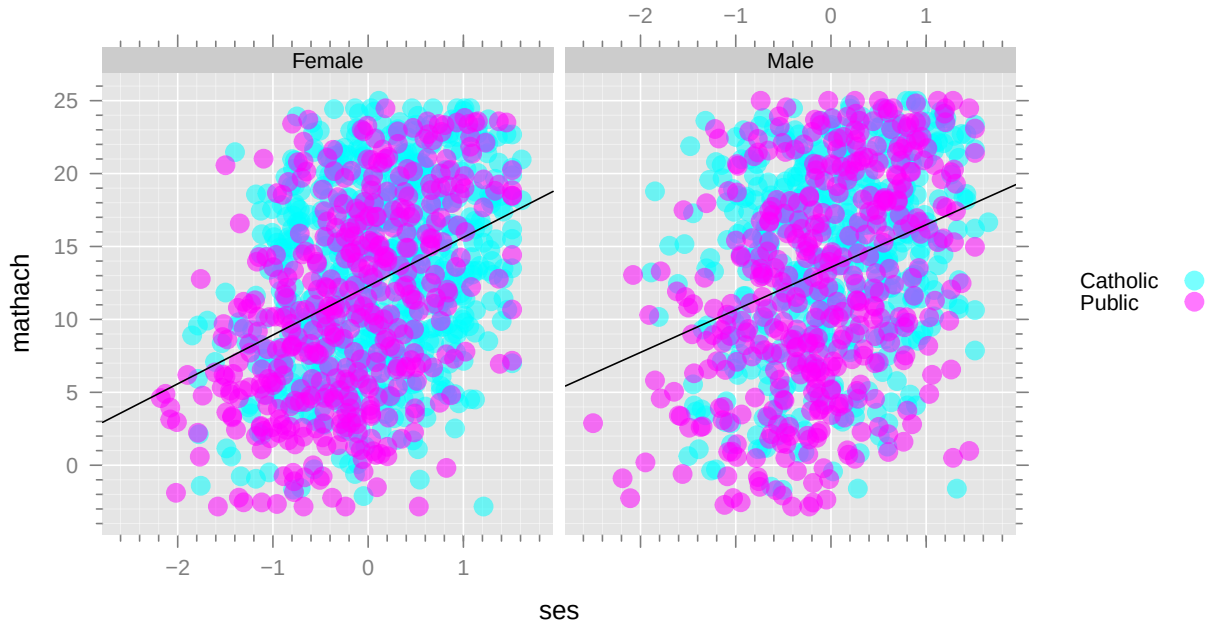



```
#
# What happens if you use 'layer'
#
```

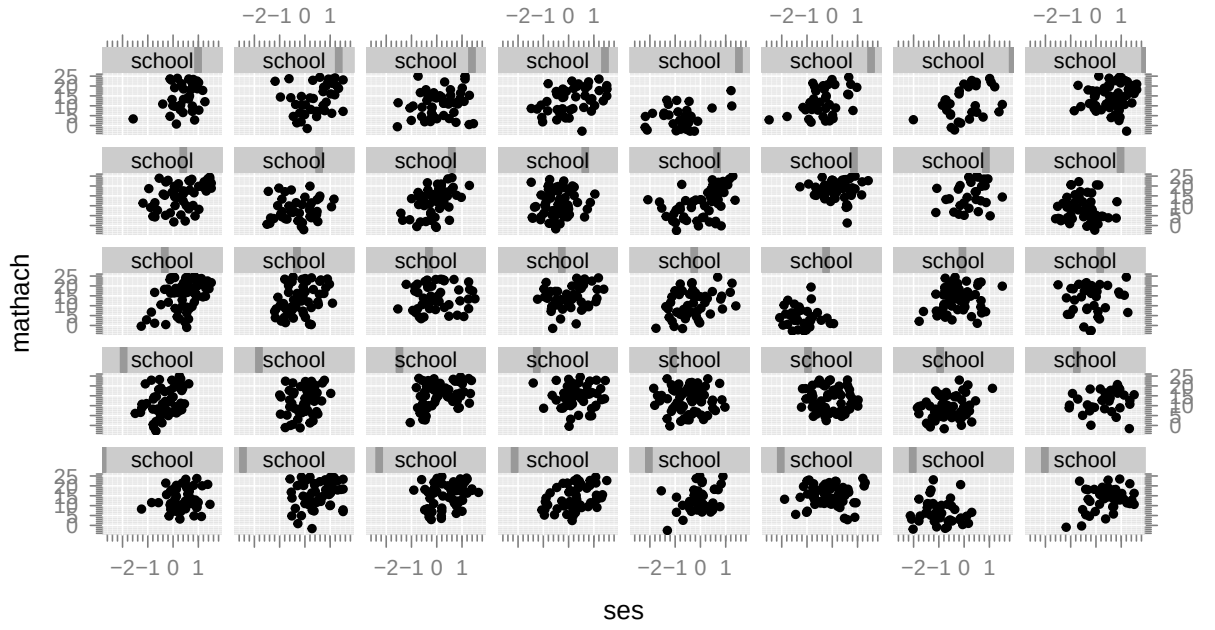
this is text

```
#
```

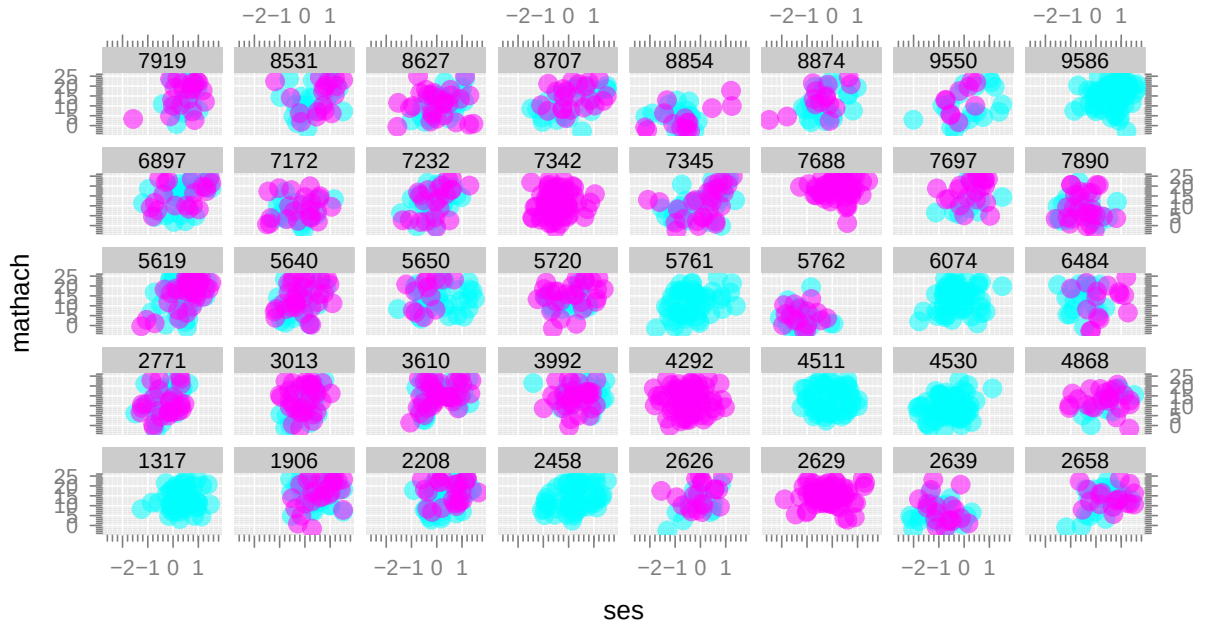
```
p + layer(panel.lmline(...))   # layer does not use groups, only panels
```




```
#
#  One panel per school
#
xyplot(mathach ~ ses | school, hs )
```




```
xyplot(mathach ~ ses | factor(school), hs , groups = Sex)
```




```
#
#  Let's get back to defaults
#
graphics.off()
xyplot(mathach ~ ses | factor(school), hs , groups = Sex)
#
# Plotting fitted curves
#
# Let's put Catholic and Public schools together
#
hsm <- within(
  hs,
  {
    id <- paste(Sector, school)
  }
)
xyplot(mathach ~ ses | id, hsm , groups = Sex)
?xyplot
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       par.strip.text = list(cex=2))  # oops
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       par.strip.text = list(cex=.1))  # re-oops
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       par.strip.text = list(cex=.6))  # just right?
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(8,6),               # breaks convention
       par.strip.text = list(cex=.6))
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(8,6),               # breaks convention
```

```
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.6))
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       # skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(7,6),               # breaks convention
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.6),
       auto.key = list(space = 'right'))
td(cex = .6)
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       # skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(7,6),               # breaks convention
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.5, font =4),
       auto.key = list(space = 'right'))

# ordering schools by mean ses within each Sector
hsm <- within(
  hsm,
  {
    id <- factor(paste(Sector, school))
    id <- reorder(id, ses)
  }
)
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       # skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(7,6),               # breaks convention
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.6),
       auto.key = list(space = 'right'))
# oops
hsm <- within(
  hsm,
  {
    id1 <- factor(paste(Sector, school))
    id <- reorder(id1, ses + I(Sector == 'Public')*1000)
  }
)
levels(hsm$id)
```

```
##  [1] "Catholic 4530" "Catholic 4292" "Catholic 7342" "Catholic 5761"
##  [5] "Catholic 7172" "Catholic 6074" "Catholic 2629" "Catholic 4511"
##  [9] "Catholic 5650" "Catholic 5720" "Catholic 3610" "Catholic 7688"
## [13] "Catholic 2458" "Catholic 1317" "Catholic 4868" "Catholic 3992"
## [17] "Catholic 5619" "Catholic 2208" "Catholic 2658" "Catholic 1906"
## [21] "Catholic 9586" "Public 5762"   "Public 2639"   "Public 8854"
## [25] "Public 7890"   "Public 8874"   "Public 2771"   "Public 6484"
## [29] "Public 5640"   "Public 7232"   "Public 2626"   "Public 3013"
## [33] "Public 7345"   "Public 9550"   "Public 8627"   "Public 8707"
## [37] "Public 7697"   "Public 6897"   "Public 8531"   "Public 7919"
```

```
tab(hsm, ~ id)
```

```
## id
## Catholic 4530 Catholic 4292 Catholic 7342 Catholic 5761 Catholic 7172
```

```
##            63            65            58            52            44
## Catholic 6074 Catholic 2629 Catholic 4511 Catholic 5650 Catholic 5720
##            56            57            58            45            53
## Catholic 3610 Catholic 7688 Catholic 2458 Catholic 1317 Catholic 4868
##            64            54            57            48            34
## Catholic 3992 Catholic 5619 Catholic 2208 Catholic 2658 Catholic 1906
##            53            66            60            45            53
## Catholic 9586   Public 5762   Public 2639   Public 8854   Public 7890
##            59            37            42            32            51
##   Public 8874   Public 2771   Public 6484   Public 5640   Public 7232
##            36            55            35            57            52
##   Public 2626   Public 3013   Public 7345   Public 9550   Public 8627
##            38            53            56            29            53
##   Public 8707   Public 7697   Public 6897   Public 8531   Public 7919
##            48            32            49            41            37
##         Total
##          1977
```

```
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       # skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(7,6),               # breaks convention
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.6),
       auto.key = list(space = 'right'))
#
# Showing fitted lines, no matter how complicated the
# model is:
#
fit <- lm(mathach ~ id * (ses + I(ses^2)) -1, hsm)
summary(fit)
```

```
##
## Call:
## lm(formula = mathach ~ id * (ses + I(ses^2)) - 1, data = hsm)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.8020  -4.3850   0.0867   4.6293  15.7879
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## idCatholic 4530          10.01059    1.07184   9.340  < 2e-16 ***
## idCatholic 4292          12.72055    0.98804  12.875  < 2e-16 ***
## idCatholic 7342          11.73401    1.10754  10.595  < 2e-16 ***
## idCatholic 5761          12.71133    1.17129  10.852  < 2e-16 ***
## idCatholic 7172           7.93797    1.21814   6.516 9.25e-11 ***
## idCatholic 6074          15.13541    1.03444  14.632  < 2e-16 ***
## idCatholic 2629          14.97213    1.02718  14.576  < 2e-16 ***
## idCatholic 4511          13.37015    1.10166  12.136  < 2e-16 ***
## idCatholic 5650          15.00181    1.25056  11.996  < 2e-16 ***
## idCatholic 5720          13.24431    1.17893  11.234  < 2e-16 ***
## idCatholic 3610          15.90561    1.07297  14.824  < 2e-16 ***
## idCatholic 7688          18.11808    1.07085  16.919  < 2e-16 ***
## idCatholic 2458          13.49686    1.07631  12.540  < 2e-16 ***
## idCatholic 1317          12.96791    1.15156  11.261  < 2e-16 ***
```

```
## idCatholic 4868          12.35744    1.51301   8.167 5.75e-16 ***
## idCatholic 3992          13.96283    1.11677  12.503  < 2e-16 ***
## idCatholic 5619          13.75283    1.06068  12.966  < 2e-16 ***
## idCatholic 2208          13.99106    1.06493  13.138  < 2e-16 ***
## idCatholic 2658          13.23269    1.24853  10.599  < 2e-16 ***
## idCatholic 1906          14.91769    1.13443  13.150  < 2e-16 ***
## idCatholic 9586          13.72970    1.18083  11.627  < 2e-16 ***
## idPublic 5762             2.52338    3.60821   0.699 0.484424
## idPublic 2639             4.91313    2.03005   2.420 0.015607 *
## idPublic 8854             5.19780    1.53332   3.390 0.000714 ***
## idPublic 7890             8.31807    1.17092   7.104 1.72e-12 ***
## idPublic 8874            13.48457    1.17188  11.507  < 2e-16 ***
## idPublic 2771            12.91776    1.03662  12.461  < 2e-16 ***
## idPublic 6484            11.82948    1.38365   8.549  < 2e-16 ***
## idPublic 5640            14.05336    1.10239  12.748  < 2e-16 ***
## idPublic 7232            13.00320    1.04741  12.415  < 2e-16 ***
## idPublic 2626            13.51240    1.18931  11.362  < 2e-16 ***
## idPublic 3013            12.20352    1.10539  11.040  < 2e-16 ***
## idPublic 7345             9.07675    1.13412   8.003 2.11e-15 ***
## idPublic 9550            11.18870    1.38201   8.096 1.02e-15 ***
## idPublic 8627            11.16657    1.07883  10.351  < 2e-16 ***
## idPublic 8707            12.34988    1.19489  10.336  < 2e-16 ***
## idPublic 7697            15.43375    1.45484  10.609  < 2e-16 ***
## idPublic 6897            12.99412    1.20441  10.789  < 2e-16 ***
## idPublic 8531            10.06124    1.33637   7.529 7.94e-14 ***
## idPublic 7919            13.65754    1.56362   8.735  < 2e-16 ***
## ses                       2.70852    2.21786   1.221 0.222153
## I(ses^2)                  0.89941    1.55392   0.579 0.562794
## idCatholic 4292:ses      -2.55638    2.84111  -0.900 0.368352
## idCatholic 7342:ses      -2.02787    2.90392  -0.698 0.485062
## idCatholic 5761:ses       0.12888    2.54420   0.051 0.959605
## idCatholic 7172:ses      -1.09711    2.80330  -0.391 0.695575
## idCatholic 6074:ses      -2.08657    2.62660  -0.794 0.427064
## idCatholic 2629:ses      -2.50756    2.53052  -0.991 0.321850
## idCatholic 4511:ses      -2.64044    2.65387  -0.995 0.319896
## idCatholic 5650:ses      -1.69394    2.54302  -0.666 0.505422
## idCatholic 5720:ses      -0.50897    2.56829  -0.198 0.842931
## idCatholic 3610:ses       1.33105    2.68053   0.497 0.619556
## idCatholic 7688:ses      -2.81208    2.71213  -1.037 0.299939
## idCatholic 2458:ses       0.40573    2.60057   0.156 0.876038
## idCatholic 1317:ses      -0.96564    2.91482  -0.331 0.740466
## idCatholic 4868:ses      -0.96765    2.80513  -0.345 0.730166
## idCatholic 3992:ses      -2.88470    2.73596  -1.054 0.291853
## idCatholic 5619:ses       3.30789    2.65690   1.245 0.213282
## idCatholic 2208:ses      -1.23313    3.11125  -0.396 0.691897
## idCatholic 2658:ses       2.08876    2.93020   0.713 0.476035
## idCatholic 1906:ses      -0.30491    3.51299  -0.087 0.930843
## idCatholic 9586:ses      -1.76341    3.22327  -0.547 0.584384
## idPublic 5762:ses        -5.22575    7.11626  -0.734 0.462835
## idPublic 2639:ses        -7.61353    4.78966  -1.590 0.112100
## idPublic 8854:ses         1.03951    2.88292   0.361 0.718457
## idPublic 7890:ses        -5.92537    3.31957  -1.785 0.074427 .
## idPublic 8874:ses         1.24831    2.94254   0.424 0.671448
## idPublic 2771:ses         4.32025    3.56796   1.211 0.226108
```

```
## idPublic 6484:ses        -1.91204    2.68357  -0.713 0.476244
## idPublic 5640:ses         0.97471    2.66409   0.366 0.714504
## idPublic 7232:ses         2.28523    2.71367   0.842 0.399830
## idPublic 2626:ses         1.62858    3.03009   0.537 0.591008
## idPublic 3013:ses         1.58813    2.88974   0.550 0.582676
## idPublic 7345:ses         2.60778    2.46581   1.058 0.290387
## idPublic 9550:ses         1.17193    2.66091   0.440 0.659682
## idPublic 8627:ses        -0.76542    2.52184  -0.304 0.761532
## idPublic 8707:ses         0.67889    2.51240   0.270 0.787025
## idPublic 7697:ses         0.74833    2.89691   0.258 0.796188
## idPublic 6897:ses        -0.21824    2.67756  -0.082 0.935047
## idPublic 8531:ses        -2.58491    2.85663  -0.905 0.365647
## idPublic 7919:ses         1.47292    2.92821   0.503 0.615018
## idCatholic 4292:I(ses^2) -0.56633    2.10565  -0.269 0.787991
## idCatholic 7342:I(ses^2) -1.41056    2.42736  -0.581 0.561237
## idCatholic 5761:I(ses^2) -1.99069    2.06658  -0.963 0.335535
## idCatholic 7172:I(ses^2)  0.22239    2.42363   0.092 0.926898
## idCatholic 6074:I(ses^2) -3.45790    2.11335  -1.636 0.101965
## idCatholic 2629:I(ses^2) -0.97149    2.03248  -0.478 0.632718
## idCatholic 4511:I(ses^2) -0.76502    2.76968  -0.276 0.782416
## idCatholic 5650:I(ses^2) -2.16819    2.13444  -1.016 0.309850
## idCatholic 5720:I(ses^2)  1.32794    2.47417   0.537 0.591523
## idCatholic 3610:I(ses^2) -3.44361    2.59558  -1.327 0.184764
## idCatholic 7688:I(ses^2)  0.03217    2.55938   0.013 0.989974
## idCatholic 2458:I(ses^2) -1.36106    2.25209  -0.604 0.545682
## idCatholic 1317:I(ses^2) -1.82828    2.52894  -0.723 0.469805
## idCatholic 4868:I(ses^2) -1.99016    2.55122  -0.780 0.435443
## idCatholic 3992:I(ses^2)  0.61490    2.27315   0.271 0.786800
## idCatholic 5619:I(ses^2) -2.53855    2.21457  -1.146 0.251821
## idCatholic 2208:I(ses^2)  0.58738    2.70666   0.217 0.828221
## idCatholic 2658:I(ses^2) -4.17022    2.46232  -1.694 0.090506 .
## idCatholic 1906:I(ses^2) -1.15967    2.83312  -0.409 0.682349
## idCatholic 9586:I(ses^2) -0.15410    2.50153  -0.062 0.950885
## idPublic 5762:I(ses^2)   -1.61436    3.44634  -0.468 0.639534
## idPublic 2639:I(ses^2)   -3.22209    2.65218  -1.215 0.224564
## idPublic 8854:I(ses^2)    0.66802    1.88795   0.354 0.723503
## idPublic 7890:I(ses^2)   -3.58194    2.60491  -1.375 0.169275
## idPublic 8874:I(ses^2)   -1.03213    1.97710  -0.522 0.601702
## idPublic 2771:I(ses^2)    2.60645    3.28585   0.793 0.427741
## idPublic 6484:I(ses^2)    1.53878    2.37285   0.648 0.516747
## idPublic 5640:I(ses^2)   -1.56438    2.66528  -0.587 0.557309
## idPublic 7232:I(ses^2)   -0.93123    2.49060  -0.374 0.708523
## idPublic 2626:I(ses^2)   -0.36519    2.78336  -0.131 0.895629
## idPublic 3013:I(ses^2)    1.72111    3.60409   0.478 0.633030
## idPublic 7345:I(ses^2)    2.20906    1.93524   1.141 0.253813
## idPublic 9550:I(ses^2)   -1.41060    2.03551  -0.693 0.488398
## idPublic 8627:I(ses^2)   -1.86784    2.05813  -0.908 0.364238
## idPublic 8707:I(ses^2)   -0.88635    2.02375  -0.438 0.661454
## idPublic 7697:I(ses^2)   -2.30190    2.78462  -0.827 0.408542
## idPublic 6897:I(ses^2)    0.95425    2.20746   0.432 0.665584
## idPublic 8531:I(ses^2)    4.59750    2.46988   1.861 0.062842 .
## idPublic 7919:I(ses^2)   -2.37228    2.47418  -0.959 0.337778
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 6.104 on 1857 degrees of freedom
## Multiple R-squared:  0.8335, Adjusted R-squared:  0.8227
## F-statistic: 77.46 on 120 and 1857 DF,  p-value: < 2.2e-16
```

```
wald(fit, 'ses\\^2')
```

```
##         numDF denDF  F-value p-value
## ses\\^2    40  1857 1.052798 0.38154
##                           Estimate  Std.Error DF   t-value   p-value Lower 0.95
## I(ses^2)                   0.899412 1.553923  1857  0.578801 0.56279 -2.148208
## idCatholic 4292:I(ses^2) -0.566335 2.105649  1857 -0.268960 0.78799 -4.696022
## idCatholic 7342:I(ses^2) -1.410563 2.427364  1857 -0.581109 0.56124 -6.171212
## idCatholic 5761:I(ses^2) -1.990686 2.066583  1857 -0.963274 0.33554 -6.043756
## idCatholic 7172:I(ses^2)  0.222394 2.423634  1857  0.091760 0.92690 -4.530940
## idCatholic 6074:I(ses^2) -3.457896 2.113355  1857 -1.636212 0.10196 -7.602696
## idCatholic 2629:I(ses^2) -0.971492 2.032480  1857 -0.477984 0.63272 -4.957678
## idCatholic 4511:I(ses^2) -0.765020 2.769683  1857 -0.276212 0.78242 -6.197038
## idCatholic 5650:I(ses^2) -2.168194 2.134438  1857 -1.015815 0.30985 -6.354345
## idCatholic 5720:I(ses^2)  1.327945 2.474170  1857  0.536723 0.59152 -3.524502
## idCatholic 3610:I(ses^2) -3.443609 2.595575  1857 -1.326723 0.18476 -8.534161
## idCatholic 7688:I(ses^2)  0.032167 2.559379  1857  0.012568 0.98997 -4.987396
## idCatholic 2458:I(ses^2) -1.361058 2.252086  1857 -0.604354 0.54568 -5.777945
## idCatholic 1317:I(ses^2) -1.828281 2.528940  1857 -0.722944 0.46981 -6.788145
## idCatholic 4868:I(ses^2) -1.990157 2.551221  1857 -0.780080 0.43544 -6.993720
## idCatholic 3992:I(ses^2)  0.614903 2.273147  1857  0.270507 0.78680 -3.843288
## idCatholic 5619:I(ses^2) -2.538551 2.214571  1857 -1.146294 0.25182 -6.881861
## idCatholic 2208:I(ses^2)  0.587384 2.706660  1857  0.217014 0.82822 -4.721032
## idCatholic 2658:I(ses^2) -4.170223 2.462322  1857 -1.693614 0.09051 -8.999433
## idCatholic 1906:I(ses^2) -1.159667 2.833123  1857 -0.409325 0.68235 -6.716108
## idCatholic 9586:I(ses^2) -0.154105 2.501534  1857 -0.061604 0.95088 -5.060220
## idPublic 5762:I(ses^2)   -1.614360 3.446341  1857 -0.468427 0.63953 -8.373469
## idPublic 2639:I(ses^2)   -3.222090 2.652176  1857 -1.214885 0.22456 -8.423649
## idPublic 8854:I(ses^2)    0.668020 1.887945  1857  0.353834 0.72350 -3.034698
## idPublic 7890:I(ses^2)   -3.581938 2.604910  1857 -1.375071 0.16928 -8.690798
## idPublic 8874:I(ses^2)   -1.032132 1.977095  1857 -0.522045 0.60170 -4.909695
## idPublic 2771:I(ses^2)    2.606453 3.285846  1857  0.793236 0.42774 -3.837887
## idPublic 6484:I(ses^2)    1.538777 2.372854  1857  0.648492 0.51675 -3.114964
## idPublic 5640:I(ses^2)   -1.564380 2.665275  1857 -0.586949 0.55731 -6.791631
## idPublic 7232:I(ses^2)   -0.931230 2.490596  1857 -0.373898 0.70852 -5.815891
## idPublic 2626:I(ses^2)   -0.365186 2.783355  1857 -0.131203 0.89563 -5.824020
## idPublic 3013:I(ses^2)    1.721114 3.604085  1857  0.477545 0.63303 -5.347371
## idPublic 7345:I(ses^2)    2.209061 1.935243  1857  1.141490 0.25381 -1.586419
## idPublic 9550:I(ses^2)   -1.410605 2.035513  1857 -0.692997 0.48840 -5.402739
## idPublic 8627:I(ses^2)   -1.867837 2.058128  1857 -0.907542 0.36424 -5.904324
## idPublic 8707:I(ses^2)   -0.886354 2.023746  1857 -0.437977 0.66145 -4.855410
## idPublic 7697:I(ses^2)   -2.301902 2.784620  1857 -0.826649 0.40854 -7.763217
## idPublic 6897:I(ses^2)    0.954254 2.207458  1857  0.432286 0.66558 -3.375106
## idPublic 8531:I(ses^2)    4.597497 2.469884  1857  1.861423 0.06284 -0.246543
## idPublic 7919:I(ses^2)   -2.372279 2.474183  1857 -0.958813 0.33778 -7.224750
##                           Upper 0.95
## I(ses^2)                  3.947033
## idCatholic 4292:I(ses^2) 3.563352
## idCatholic 7342:I(ses^2) 3.350085
## idCatholic 5761:I(ses^2) 2.062384
```

```
## idCatholic 7172:I(ses^2) 4.975727
## idCatholic 6074:I(ses^2) 0.686905
## idCatholic 2629:I(ses^2) 3.014693
## idCatholic 4511:I(ses^2) 4.666999
## idCatholic 5650:I(ses^2) 2.017956
## idCatholic 5720:I(ses^2) 6.180392
## idCatholic 3610:I(ses^2) 1.646943
## idCatholic 7688:I(ses^2) 5.051730
## idCatholic 2458:I(ses^2) 3.055828
## idCatholic 1317:I(ses^2) 3.131582
## idCatholic 4868:I(ses^2) 3.013406
## idCatholic 3992:I(ses^2) 5.073094
## idCatholic 5619:I(ses^2) 1.804760
## idCatholic 2208:I(ses^2) 5.895801
## idCatholic 2658:I(ses^2) 0.658987
## idCatholic 1906:I(ses^2) 4.396774
## idCatholic 9586:I(ses^2) 4.752010
## idPublic 5762:I(ses^2)   5.144749
## idPublic 2639:I(ses^2)   1.979470
## idPublic 8854:I(ses^2)   4.370738
## idPublic 7890:I(ses^2)   1.526922
## idPublic 8874:I(ses^2)   2.845431
## idPublic 2771:I(ses^2)   9.050793
## idPublic 6484:I(ses^2)   6.192518
## idPublic 5640:I(ses^2)   3.662871
## idPublic 7232:I(ses^2)   3.953432
## idPublic 2626:I(ses^2)   5.093649
## idPublic 3013:I(ses^2)   8.789598
## idPublic 7345:I(ses^2)   6.004541
## idPublic 9550:I(ses^2)   2.581530
## idPublic 8627:I(ses^2)   2.168650
## idPublic 8707:I(ses^2)   3.082702
## idPublic 7697:I(ses^2)   3.159412
## idPublic 6897:I(ses^2)   5.283613
## idPublic 8531:I(ses^2)   9.441537
## idPublic 7919:I(ses^2)   2.480193
```

```
wald(fit, ':')  # maybe don't need interaction?  Which means??
```

```
##   numDF denDF  F-value p-value
## :    78  1857 1.209828 0.10579
##                          Estimate  Std.Error DF   t-value   p-value Lower 0.95
## idCatholic 4292:ses      -2.556380 2.841107  1857 -0.899783 0.36835  -8.128479
## idCatholic 7342:ses      -2.027874 2.903917  1857 -0.698324 0.48506  -7.723158
## idCatholic 5761:ses       0.128878 2.544202  1857  0.050656 0.95961  -4.860918
## idCatholic 7172:ses      -1.097105 2.803301  1857 -0.391362 0.69557  -6.595058
## idCatholic 6074:ses      -2.086574 2.626605  1857 -0.794400 0.42706  -7.237982
## idCatholic 2629:ses      -2.507564 2.530522  1857 -0.990928 0.32185  -7.470530
## idCatholic 4511:ses      -2.640440 2.653872  1857 -0.994939 0.31990  -7.845326
## idCatholic 5650:ses      -1.693939 2.543020  1857 -0.666113 0.50542  -6.681417
## idCatholic 5720:ses      -0.508969 2.568292  1857 -0.198174 0.84293  -5.546012
## idCatholic 3610:ses       1.331052 2.680532  1857  0.496563 0.61956  -3.926120
## idCatholic 7688:ses      -2.812078 2.712126  1857 -1.036854 0.29994  -8.131213
## idCatholic 2458:ses       0.405729 2.600566  1857  0.156015 0.87604  -4.694612
## idCatholic 1317:ses      -0.965637 2.914818  1857 -0.331286 0.74047  -6.682301
```

```
## idCatholic 4868:ses      -0.967650 2.805133  1857 -0.344957 0.73017  -6.469196
## idCatholic 3992:ses      -2.884701 2.735960  1857 -1.054365 0.29185  -8.250581
## idCatholic 5619:ses       3.307889 2.656898  1857  1.245019 0.21328  -1.902932
## idCatholic 2208:ses      -1.233128 3.111254  1857 -0.396344 0.69190  -7.335051
## idCatholic 2658:ses       2.088760 2.930201  1857  0.712838 0.47604  -3.658074
## idCatholic 1906:ses      -0.304914 3.512991  1857 -0.086796 0.93084  -7.194740
## idCatholic 9586:ses      -1.763412 3.223272  1857 -0.547087 0.58438  -8.085029
## idPublic 5762:ses        -5.225748 7.116260  1857 -0.734339 0.46283 -19.182458
## idPublic 2639:ses        -7.613531 4.789657  1857 -1.589577 0.11210 -17.007209
## idPublic 8854:ses         1.039515 2.882921  1857  0.360577 0.71846  -4.614592
## idPublic 7890:ses        -5.925369 3.319565  1857 -1.784984 0.07443 -12.435840
## idPublic 8874:ses         1.248311 2.942544  1857  0.424229 0.67145  -4.522730
## idPublic 2771:ses         4.320252 3.567961  1857  1.210846 0.22611  -2.677385
## idPublic 6484:ses        -1.912042 2.683566  1857 -0.712501 0.47624  -7.175165
## idPublic 5640:ses         0.974712 2.664093  1857  0.365870 0.71450  -4.250219
## idPublic 7232:ses         2.285230 2.713668  1857  0.842118 0.39983  -3.036931
## idPublic 2626:ses         1.628579 3.030088  1857  0.537469 0.59101  -4.314158
## idPublic 3013:ses         1.588132 2.889736  1857  0.549577 0.58268  -4.079341
## idPublic 7345:ses         2.607778 2.465812  1857  1.057574 0.29039  -2.228277
## idPublic 9550:ses         1.171929 2.660915  1857  0.440424 0.65968  -4.046769
## idPublic 8627:ses        -0.765416 2.521844  1857 -0.303514 0.76153  -5.711363
## idPublic 8707:ses         0.678888 2.512400  1857  0.270215 0.78702  -4.248537
## idPublic 7697:ses         0.748332 2.896914  1857  0.258320 0.79619  -4.933218
## idPublic 6897:ses        -0.218243 2.677559  1857 -0.081508 0.93505  -5.469584
## idPublic 8531:ses        -2.584909 2.856633  1857 -0.904879 0.36565  -8.187458
## idPublic 7919:ses         1.472918 2.928214  1857  0.503009 0.61502  -4.270019
## idCatholic 4292:I(ses^2) -0.566335 2.105649  1857 -0.268960 0.78799  -4.696022
## idCatholic 7342:I(ses^2) -1.410563 2.427364  1857 -0.581109 0.56124  -6.171212
## idCatholic 5761:I(ses^2) -1.990686 2.066583  1857 -0.963274 0.33554  -6.043756
## idCatholic 7172:I(ses^2)  0.222394 2.423634  1857  0.091760 0.92690  -4.530940
## idCatholic 6074:I(ses^2) -3.457896 2.113355  1857 -1.636212 0.10196  -7.602696
## idCatholic 2629:I(ses^2) -0.971492 2.032480  1857 -0.477984 0.63272  -4.957678
## idCatholic 4511:I(ses^2) -0.765020 2.769683  1857 -0.276212 0.78242  -6.197038
## idCatholic 5650:I(ses^2) -2.168194 2.134438  1857 -1.015815 0.30985  -6.354345
## idCatholic 5720:I(ses^2)  1.327945 2.474170  1857  0.536723 0.59152  -3.524502
## idCatholic 3610:I(ses^2) -3.443609 2.595575  1857 -1.326723 0.18476  -8.534161
## idCatholic 7688:I(ses^2)  0.032167 2.559379  1857  0.012568 0.98997  -4.987396
## idCatholic 2458:I(ses^2) -1.361058 2.252086  1857 -0.604354 0.54568  -5.777945
## idCatholic 1317:I(ses^2) -1.828281 2.528940  1857 -0.722944 0.46981  -6.788145
## idCatholic 4868:I(ses^2) -1.990157 2.551221  1857 -0.780080 0.43544  -6.993720
## idCatholic 3992:I(ses^2)  0.614903 2.273147  1857  0.270507 0.78680  -3.843288
## idCatholic 5619:I(ses^2) -2.538551 2.214571  1857 -1.146294 0.25182  -6.881861
## idCatholic 2208:I(ses^2)  0.587384 2.706660  1857  0.217014 0.82822  -4.721032
## idCatholic 2658:I(ses^2) -4.170223 2.462322  1857 -1.693614 0.09051  -8.999433
## idCatholic 1906:I(ses^2) -1.159667 2.833123  1857 -0.409325 0.68235  -6.716108
## idCatholic 9586:I(ses^2) -0.154105 2.501534  1857 -0.061604 0.95088  -5.060220
## idPublic 5762:I(ses^2)   -1.614360 3.446341  1857 -0.468427 0.63953  -8.373469
## idPublic 2639:I(ses^2)   -3.222090 2.652176  1857 -1.214885 0.22456  -8.423649
## idPublic 8854:I(ses^2)    0.668020 1.887945  1857  0.353834 0.72350  -3.034698
## idPublic 7890:I(ses^2)   -3.581938 2.604910  1857 -1.375071 0.16928  -8.690798
## idPublic 8874:I(ses^2)   -1.032132 1.977095  1857 -0.522045 0.60170  -4.909695
## idPublic 2771:I(ses^2)    2.606453 3.285846  1857  0.793236 0.42774  -3.837887
## idPublic 6484:I(ses^2)    1.538777 2.372854  1857  0.648492 0.51675  -3.114964
## idPublic 5640:I(ses^2)   -1.564380 2.665275  1857 -0.586949 0.55731  -6.791631
```

```
## idPublic 7232:I(ses^2)   -0.931230 2.490596  1857 -0.373898 0.70852  -5.815891
## idPublic 2626:I(ses^2)   -0.365186 2.783355  1857 -0.131203 0.89563  -5.824020
## idPublic 3013:I(ses^2)    1.721114 3.604085  1857  0.477545 0.63303  -5.347371
## idPublic 7345:I(ses^2)    2.209061 1.935243  1857  1.141490 0.25381  -1.586419
## idPublic 9550:I(ses^2)   -1.410605 2.035513  1857 -0.692997 0.48840  -5.402739
## idPublic 8627:I(ses^2)   -1.867837 2.058128  1857 -0.907542 0.36424  -5.904324
## idPublic 8707:I(ses^2)   -0.886354 2.023746  1857 -0.437977 0.66145  -4.855410
## idPublic 7697:I(ses^2)   -2.301902 2.784620  1857 -0.826649 0.40854  -7.763217
## idPublic 6897:I(ses^2)    0.954254 2.207458  1857  0.432286 0.66558  -3.375106
## idPublic 8531:I(ses^2)    4.597497 2.469884  1857  1.861423 0.06284  -0.246543
## idPublic 7919:I(ses^2)   -2.372279 2.474183  1857 -0.958813 0.33778  -7.224750
##                          Upper 0.95
## idCatholic 4292:ses       3.015719
## idCatholic 7342:ses       3.667410
## idCatholic 5761:ses       5.118674
## idCatholic 7172:ses       4.400847
## idCatholic 6074:ses       3.064835
## idCatholic 2629:ses       2.455403
## idCatholic 4511:ses       2.564445
## idCatholic 5650:ses       3.293540
## idCatholic 5720:ses       4.528074
## idCatholic 3610:ses       6.588225
## idCatholic 7688:ses       2.507058
## idCatholic 2458:ses       5.506069
## idCatholic 1317:ses       4.751026
## idCatholic 4868:ses       4.533896
## idCatholic 3992:ses       2.481180
## idCatholic 5619:ses       8.518709
## idCatholic 2208:ses       4.868796
## idCatholic 2658:ses       7.835594
## idCatholic 1906:ses       6.584913
## idCatholic 9586:ses       4.558206
## idPublic 5762:ses         8.730961
## idPublic 2639:ses         1.780148
## idPublic 8854:ses         6.693622
## idPublic 7890:ses         0.585102
## idPublic 8874:ses         7.019352
## idPublic 2771:ses        11.317888
## idPublic 6484:ses         3.351080
## idPublic 5640:ses         6.199644
## idPublic 7232:ses         7.607390
## idPublic 2626:ses         7.571317
## idPublic 3013:ses         7.255604
## idPublic 7345:ses         7.443834
## idPublic 9550:ses         6.390628
## idPublic 8627:ses         4.180531
## idPublic 8707:ses         5.606313
## idPublic 7697:ses         6.429882
## idPublic 6897:ses         5.033098
## idPublic 8531:ses         3.017641
## idPublic 7919:ses         7.215855
## idCatholic 4292:I(ses^2)  3.563352
## idCatholic 7342:I(ses^2)  3.350085
## idCatholic 5761:I(ses^2)  2.062384
```

```
## idCatholic 7172:I(ses^2)  4.975727
## idCatholic 6074:I(ses^2)  0.686905
## idCatholic 2629:I(ses^2)  3.014693
## idCatholic 4511:I(ses^2)  4.666999
## idCatholic 5650:I(ses^2)  2.017956
## idCatholic 5720:I(ses^2)  6.180392
## idCatholic 3610:I(ses^2)  1.646943
## idCatholic 7688:I(ses^2)  5.051730
## idCatholic 2458:I(ses^2)  3.055828
## idCatholic 1317:I(ses^2)  3.131582
## idCatholic 4868:I(ses^2)  3.013406
## idCatholic 3992:I(ses^2)  5.073094
## idCatholic 5619:I(ses^2)  1.804760
## idCatholic 2208:I(ses^2)  5.895801
## idCatholic 2658:I(ses^2)  0.658987
## idCatholic 1906:I(ses^2)  4.396774
## idCatholic 9586:I(ses^2)  4.752010
## idPublic 5762:I(ses^2)    5.144749
## idPublic 2639:I(ses^2)    1.979470
## idPublic 8854:I(ses^2)    4.370738
## idPublic 7890:I(ses^2)    1.526922
## idPublic 8874:I(ses^2)    2.845431
## idPublic 2771:I(ses^2)    9.050793
## idPublic 6484:I(ses^2)    6.192518
## idPublic 5640:I(ses^2)    3.662871
## idPublic 7232:I(ses^2)    3.953432
## idPublic 2626:I(ses^2)    5.093649
## idPublic 3013:I(ses^2)    8.789598
## idPublic 7345:I(ses^2)    6.004541
## idPublic 9550:I(ses^2)    2.581530
## idPublic 8627:I(ses^2)    2.168650
## idPublic 8707:I(ses^2)    3.082702
## idPublic 7697:I(ses^2)    3.159412
## idPublic 6897:I(ses^2)    5.283613
## idPublic 8531:I(ses^2)    9.441537
## idPublic 7919:I(ses^2)    2.480193
```

```
#
# Making a data frame with all combinations of predictor
# values you want to plot:
#
# - Usual solution in R uses 'expand.grid'
# - Made easier with the following function 'pred.grid'
#   now in the the spida2 package but you would need to
#   reinstall spida2
#
pred.grid <- function(...) {
  nams <- as.character(as.list(substitute(list(...)))[-1L])
  x <- list(...)
  names(x)[names(x) == ''] <- nams[names(x) == '']
  x <- lapply(x, unique)
  do.call(expand.grid, x)
}
#
```

```r
# Now we use pred.grid to create a prediction data frame:
#
# You just need to name the categorical variables in hsm that
# you need for the model. For numeric variables, provide
# a sequence of values that will produce smooth curves
# when the predicted values are plotted.
#
pred <- with(hsm, pred.grid(id, ses = seq(-4,3,.1)))
head(pred)
```

```
##              id ses
## 1 Catholic 1317  -4
## 2 Catholic 1906  -4
## 3 Catholic 2208  -4
## 4 Catholic 2458  -4
## 5   Public 2626  -4
## 6 Catholic 2629  -4
```

```r
dim(pred)   # has every combination of id and values for 'ses'
```

```
## [1] 2840    2
```

```r
# add the predicted value (I like to use the same name as the fitted model)
pred$fit <- predict(fit, newdata = pred)
head(pred)
```

```
##              id ses       fit
## 1 Catholic 1317  -4 -8.865515
## 2 Catholic 1906  -4  1.139202
## 3 Catholic 2208  -4 31.878249
## 4 Catholic 2458  -4 -6.346461
## 5   Public 2626  -4  4.711638
## 6 Catholic 2629  -4 13.015032
```

```r
# Note: if you fitted a glm model, you might want to use 'type = "response"', e.g.
pred$fit <- predict(fit, newdata = pred, type = 'response')
#
# Now we can plot the points and the fitted model
#
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       # skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(7,6),               # breaks convention
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.6),
       auto.key = list(space = 'right')) +
  xyplot(fit ~ ses | id, pred, type = 'l') # takes defaults from last plot
#
# If you want to compare with a quintic
#

fit2 <- lm(mathach ~ id * poly(ses, 5, raw = TRUE), hsm)
summary(fit2)   # probably overfitting!
```

```
##
## Call:
## lm(formula = mathach ~ id * poly(ses, 5, raw = TRUE), data = hsm)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.0542  -4.2364   0.1245   4.3144  14.6997
##
## Coefficients:
##                                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                                     8.74695    1.35805   6.441 1.53e-10
## idCatholic 4292                                 4.42539    1.99793   2.215 0.026890
## idCatholic 7342                                 3.24871    2.08024   1.562 0.118541
## idCatholic 5761                                 2.55173    2.09770   1.216 0.223982
## idCatholic 7172                                -2.38337    2.20430  -1.081 0.279743
## idCatholic 6074                                 6.27110    2.05523   3.051 0.002313
## idCatholic 2629                                 7.04759    1.91123   3.687 0.000233
## idCatholic 4511                                 4.75728    1.97708   2.406 0.016223
## idCatholic 5650                                 7.01279    2.03631   3.444 0.000587
## idCatholic 5720                                 3.68814    2.06206   1.789 0.073858
## idCatholic 3610                                 7.53593    1.96712   3.831 0.000132
## idCatholic 7688                                10.17900    1.92977   5.275 1.50e-07
## idCatholic 2458                                 4.14244    2.01482   2.056 0.039933
## idCatholic 1317                                 4.08758    1.95183   2.094 0.036384
## idCatholic 4868                                 0.91399    2.61121   0.350 0.726361
## idCatholic 3992                                 5.40371    1.92712   2.804 0.005103
## idCatholic 5619                                 6.79815    1.99314   3.411 0.000663
## idCatholic 2208                                 5.96048    2.02127   2.949 0.003232
## idCatholic 2658                                 4.25072    2.44684   1.737 0.082524
## idCatholic 1906                                 6.36333    2.16212   2.943 0.003293
## idCatholic 9586                                 5.61927    2.13602   2.631 0.008596
## idPublic 5762                                  -7.91870    4.37484  -1.810 0.070460
## idPublic 2639                                  -1.71491    3.14236  -0.546 0.585316
## idPublic 8854                                  -5.48516    3.39552  -1.615 0.106403
## idPublic 7890                                  -2.56979    2.07729  -1.237 0.216221
## idPublic 8874                                   3.93423    2.21013   1.780 0.075237
## idPublic 2771                                   4.61585    2.04034   2.262 0.023803
## idPublic 6484                                   2.03645    2.18855   0.931 0.352240
## idPublic 5640                                   3.80547    1.91933   1.983 0.047558
## idPublic 7232                                   3.76049    1.88142   1.999 0.045790
## idPublic 2626                                   5.90367    2.01537   2.929 0.003441
## idPublic 3013                                   3.61343    1.93838   1.864 0.062469
## idPublic 7345                                   0.11920    2.08229   0.057 0.954357
## idPublic 9550                                   0.88912    2.35616   0.377 0.705952
## idPublic 8627                                   0.96902    1.88155   0.515 0.606611
## idPublic 8707                                   3.75853    1.99807   1.881 0.060129
## idPublic 7697                                   4.35347    2.42604   1.794 0.072910
## idPublic 6897                                   5.74941    2.13710   2.690 0.007208
## idPublic 8531                                  -1.26563    2.24448  -0.564 0.572906
## idPublic 7919                                   5.16621    2.47174   2.090 0.036753
## poly(ses, 5, raw = TRUE)1                       1.36701    5.44701   0.251 0.801871
## poly(ses, 5, raw = TRUE)2                      11.09951   11.40689   0.973 0.330662
## poly(ses, 5, raw = TRUE)3                       7.17227    4.80200   1.494 0.135462
## poly(ses, 5, raw = TRUE)4                      -5.85356    8.77729  -0.667 0.504926
## poly(ses, 5, raw = TRUE)5                      -3.66399    3.86487  -0.948 0.343249
## idCatholic 4292:poly(ses, 5, raw = TRUE)1      -1.25545    6.61466  -0.190 0.849490
## idCatholic 7342:poly(ses, 5, raw = TRUE)1      -2.38613    7.26642  -0.328 0.742666
```

```
## idCatholic 5761:poly(ses, 5, raw = TRUE)1   0.01118    6.69246   0.002 0.998667
## idCatholic 7172:poly(ses, 5, raw = TRUE)1   0.41394    7.04566   0.059 0.953157
## idCatholic 6074:poly(ses, 5, raw = TRUE)1  -5.61348    6.52292  -0.861 0.389590
## idCatholic 2629:poly(ses, 5, raw = TRUE)1  -6.23473    6.32879  -0.985 0.324693
## idCatholic 4511:poly(ses, 5, raw = TRUE)1   0.81385    7.36518   0.110 0.912026
## idCatholic 5650:poly(ses, 5, raw = TRUE)1   3.25445    7.06269   0.461 0.645004
## idCatholic 5720:poly(ses, 5, raw = TRUE)1   7.76759    6.84916   1.134 0.256912
## idCatholic 3610:poly(ses, 5, raw = TRUE)1   2.05646    6.91725   0.297 0.766277
## idCatholic 7688:poly(ses, 5, raw = TRUE)1  -2.40967    6.94122  -0.347 0.728518
## idCatholic 2458:poly(ses, 5, raw = TRUE)1   2.67012    7.06743   0.378 0.705621
## idCatholic 1317:poly(ses, 5, raw = TRUE)1   0.86024    7.40069   0.116 0.907478
## idCatholic 4868:poly(ses, 5, raw = TRUE)1   7.36454    7.53775   0.977 0.328694
## idCatholic 3992:poly(ses, 5, raw = TRUE)1   2.55842    7.18543   0.356 0.721841
## idCatholic 5619:poly(ses, 5, raw = TRUE)1  -3.67790    6.80557  -0.540 0.588973
## idCatholic 2208:poly(ses, 5, raw = TRUE)1   3.11634    6.76062   0.461 0.644889
## idCatholic 2658:poly(ses, 5, raw = TRUE)1   1.89654    6.88327   0.276 0.782943
## idCatholic 1906:poly(ses, 5, raw = TRUE)1   3.31842    9.10215   0.365 0.715473
## idCatholic 9586:poly(ses, 5, raw = TRUE)1  -1.11521    8.07489  -0.138 0.890171
## idPublic 5762:poly(ses, 5, raw = TRUE)1    -9.77271   43.48499  -0.225 0.822210
## idPublic 2639:poly(ses, 5, raw = TRUE)1    -1.78540   10.23924  -0.174 0.861596
## idPublic 8854:poly(ses, 5, raw = TRUE)1     7.38158    9.20197   0.802 0.422562
## idPublic 7890:poly(ses, 5, raw = TRUE)1    -6.66556    8.55338  -0.779 0.435916
## idPublic 8874:poly(ses, 5, raw = TRUE)1     2.13187    7.33137   0.291 0.771249
## idPublic 2771:poly(ses, 5, raw = TRUE)1     5.73506    7.72908   0.742 0.458181
## idPublic 6484:poly(ses, 5, raw = TRUE)1    -4.95931    7.95016  -0.624 0.532841
## idPublic 5640:poly(ses, 5, raw = TRUE)1    -7.62733    7.63194  -0.999 0.317742
## idPublic 7232:poly(ses, 5, raw = TRUE)1     4.53895    7.04548   0.644 0.519508
## idPublic 2626:poly(ses, 5, raw = TRUE)1    -5.20382    7.62488  -0.682 0.495027
## idPublic 3013:poly(ses, 5, raw = TRUE)1     3.98841    8.22614   0.485 0.627846
## idPublic 7345:poly(ses, 5, raw = TRUE)1     3.37462    6.14283   0.549 0.582829
## idPublic 9550:poly(ses, 5, raw = TRUE)1     8.67245    7.71615   1.124 0.261196
## idPublic 8627:poly(ses, 5, raw = TRUE)1    -2.23493    6.76328  -0.330 0.741099
## idPublic 8707:poly(ses, 5, raw = TRUE)1     2.35536    6.98517   0.337 0.736011
## idPublic 7697:poly(ses, 5, raw = TRUE)1    12.25772    7.98282   1.536 0.124840
## idPublic 6897:poly(ses, 5, raw = TRUE)1    -2.60196    6.94795  -0.374 0.708082
## idPublic 8531:poly(ses, 5, raw = TRUE)1     1.28840    7.18336   0.179 0.857677
## idPublic 7919:poly(ses, 5, raw = TRUE)1    -2.52043    9.46035  -0.266 0.789947
## idCatholic 4292:poly(ses, 5, raw = TRUE)2 -12.56343   14.11256  -0.890 0.373466
## idCatholic 7342:poly(ses, 5, raw = TRUE)2 -16.78500   14.89880  -1.127 0.260067
## idCatholic 5761:poly(ses, 5, raw = TRUE)2  -6.07527   12.58393  -0.483 0.629313
## idCatholic 7172:poly(ses, 5, raw = TRUE)2   0.17020   15.40168   0.011 0.991184
## idCatholic 6074:poly(ses, 5, raw = TRUE)2 -15.83104   12.77129  -1.240 0.215298
## idCatholic 2629:poly(ses, 5, raw = TRUE)2 -18.24507   12.70598  -1.436 0.151198
## idCatholic 4511:poly(ses, 5, raw = TRUE)2 -11.11281   13.93534  -0.797 0.425296
## idCatholic 5650:poly(ses, 5, raw = TRUE)2 -15.84184   12.30277  -1.288 0.198034
## idCatholic 5720:poly(ses, 5, raw = TRUE)2  -5.14533   12.97109  -0.397 0.691655
## idCatholic 3610:poly(ses, 5, raw = TRUE)2 -14.68911   13.82145  -1.063 0.288031
## idCatholic 7688:poly(ses, 5, raw = TRUE)2 -15.50985   13.08078  -1.186 0.235904
## idCatholic 2458:poly(ses, 5, raw = TRUE)2  -3.23012   14.55355  -0.222 0.824381
## idCatholic 1317:poly(ses, 5, raw = TRUE)2  -9.46563   14.12751  -0.670 0.502938
## idCatholic 4868:poly(ses, 5, raw = TRUE)2   3.49345   16.67731   0.209 0.834103
## idCatholic 3992:poly(ses, 5, raw = TRUE)2 -13.14606   13.02096  -1.010 0.312824
## idCatholic 5619:poly(ses, 5, raw = TRUE)2 -18.48787   13.00969  -1.421 0.155472
## idCatholic 2208:poly(ses, 5, raw = TRUE)2 -20.95293   15.46164  -1.355 0.175544
```

```
## idCatholic 2658:poly(ses, 5, raw = TRUE)2 -10.52498   16.02500  -0.657 0.511406
## idCatholic 1906:poly(ses, 5, raw = TRUE)2 -26.87668   19.24745  -1.396 0.162780
## idCatholic 9586:poly(ses, 5, raw = TRUE)2 -10.86084   16.76339  -0.648 0.517141
## idPublic 5762:poly(ses, 5, raw = TRUE)2    20.39521  138.78501   0.147 0.883184
## idPublic 2639:poly(ses, 5, raw = TRUE)2   -40.14443   37.45484  -1.072 0.283955
## idPublic 8854:poly(ses, 5, raw = TRUE)2     1.15936   16.71125   0.069 0.944698
## idPublic 7890:poly(ses, 5, raw = TRUE)2     2.73007   18.31891   0.149 0.881547
## idPublic 8874:poly(ses, 5, raw = TRUE)2    -7.10379   13.28276  -0.535 0.592848
## idPublic 2771:poly(ses, 5, raw = TRUE)2   -16.36797   17.87288  -0.916 0.359899
## idPublic 6484:poly(ses, 5, raw = TRUE)2     0.79344   13.62052   0.058 0.953553
## idPublic 5640:poly(ses, 5, raw = TRUE)2     0.78015   13.63786   0.057 0.954389
## idPublic 7232:poly(ses, 5, raw = TRUE)2    -7.82690   12.98469  -0.603 0.546734
## idPublic 2626:poly(ses, 5, raw = TRUE)2   -25.90958   16.71887  -1.550 0.121391
## idPublic 3013:poly(ses, 5, raw = TRUE)2   -10.61564   14.97452  -0.709 0.478473
## idPublic 7345:poly(ses, 5, raw = TRUE)2    -6.26782   12.31924  -0.509 0.610969
## idPublic 9550:poly(ses, 5, raw = TRUE)2    -2.91356   12.96839  -0.225 0.822265
## idPublic 8627:poly(ses, 5, raw = TRUE)2    -3.45573   12.27064  -0.282 0.778264
## idPublic 8707:poly(ses, 5, raw = TRUE)2   -11.80720   12.22904  -0.966 0.334427
## idPublic 7697:poly(ses, 5, raw = TRUE)2     2.16413   16.37481   0.132 0.894872
## idPublic 6897:poly(ses, 5, raw = TRUE)2   -16.98009   13.35813  -1.271 0.203848
## idPublic 8531:poly(ses, 5, raw = TRUE)2     7.52025   14.78106   0.509 0.610974
## idPublic 7919:poly(ses, 5, raw = TRUE)2   -15.91105   25.86623  -0.615 0.538551
## idCatholic 4292:poly(ses, 5, raw = TRUE)3  -7.43304    7.05668  -1.053 0.292334
## idCatholic 7342:poly(ses, 5, raw = TRUE)3  -7.09871   11.17682  -0.635 0.525428
## idCatholic 5761:poly(ses, 5, raw = TRUE)3  -3.91082    7.88913  -0.496 0.620153
## idCatholic 7172:poly(ses, 5, raw = TRUE)3  -5.25366   12.54841  -0.419 0.675508
## idCatholic 6074:poly(ses, 5, raw = TRUE)3  -1.69708    9.10280  -0.186 0.852125
## idCatholic 2629:poly(ses, 5, raw = TRUE)3  -4.32053    7.31931  -0.590 0.555072
## idCatholic 4511:poly(ses, 5, raw = TRUE)3 -10.98872   16.50730  -0.666 0.505699
## idCatholic 5650:poly(ses, 5, raw = TRUE)3 -15.61848    9.32547  -1.675 0.094150
## idCatholic 5720:poly(ses, 5, raw = TRUE)3 -22.57618   11.03567  -2.046 0.040932
## idCatholic 3610:poly(ses, 5, raw = TRUE)3  -8.46199   12.73920  -0.664 0.506620
## idCatholic 7688:poly(ses, 5, raw = TRUE)3  -4.18372   12.17777  -0.344 0.731223
## idCatholic 2458:poly(ses, 5, raw = TRUE)3 -14.52783   10.33853  -1.405 0.160137
## idCatholic 1317:poly(ses, 5, raw = TRUE)3 -11.04017   11.95541  -0.923 0.355903
## idCatholic 4868:poly(ses, 5, raw = TRUE)3 -26.10495   12.31780  -2.119 0.034208
## idCatholic 3992:poly(ses, 5, raw = TRUE)3 -12.63183   10.98072  -1.150 0.250152
## idCatholic 5619:poly(ses, 5, raw = TRUE)3   9.39765    9.65749   0.973 0.330641
## idCatholic 2208:poly(ses, 5, raw = TRUE)3  -8.43748    8.59082  -0.982 0.326162
## idCatholic 2658:poly(ses, 5, raw = TRUE)3  -7.82782   12.18959  -0.642 0.520846
## idCatholic 1906:poly(ses, 5, raw = TRUE)3 -17.55405   22.66117  -0.775 0.438663
## idCatholic 9586:poly(ses, 5, raw = TRUE)3  -5.82207    9.68774  -0.601 0.547937
## idPublic 5762:poly(ses, 5, raw = TRUE)3    74.59678  173.08005   0.431 0.666525
## idPublic 2639:poly(ses, 5, raw = TRUE)3   -60.77555   62.02629  -0.980 0.327304
## idPublic 8854:poly(ses, 5, raw = TRUE)3    -9.57150    6.87396  -1.392 0.163971
## idPublic 7890:poly(ses, 5, raw = TRUE)3     2.26720   10.47743   0.216 0.828710
## idPublic 8874:poly(ses, 5, raw = TRUE)3    -5.98573    7.87136  -0.760 0.447093
## idPublic 2771:poly(ses, 5, raw = TRUE)3    -9.14335   18.82071  -0.486 0.627161
## idPublic 6484:poly(ses, 5, raw = TRUE)3     8.61815   11.87874   0.726 0.468237
## idPublic 5640:poly(ses, 5, raw = TRUE)3    25.42852   16.73491   1.519 0.128821
## idPublic 7232:poly(ses, 5, raw = TRUE)3   -10.25751   12.72967  -0.806 0.420471
## idPublic 2626:poly(ses, 5, raw = TRUE)3     9.60997   12.94113   0.743 0.457830
## idPublic 3013:poly(ses, 5, raw = TRUE)3    -7.49997   26.61065  -0.282 0.778099
## idPublic 7345:poly(ses, 5, raw = TRUE)3    -5.33105    6.17605  -0.863 0.388156
```

```
## idPublic 9550:poly(ses, 5, raw = TRUE)3   -15.54434   12.03125  -1.292 0.196530
## idPublic 8627:poly(ses, 5, raw = TRUE)3     0.37012    9.04286   0.041 0.967357
## idPublic 8707:poly(ses, 5, raw = TRUE)3    -7.82148    8.97307  -0.872 0.383513
## idPublic 7697:poly(ses, 5, raw = TRUE)3   -34.44001   15.76665  -2.184 0.029069
## idPublic 6897:poly(ses, 5, raw = TRUE)3     0.75975   10.05324   0.076 0.939767
## idPublic 8531:poly(ses, 5, raw = TRUE)3   -12.79888   10.86308  -1.178 0.238878
## idPublic 7919:poly(ses, 5, raw = TRUE)3    13.72134   30.77950   0.446 0.655801
## idCatholic 4292:poly(ses, 5, raw = TRUE)4   6.31175   12.35417   0.511 0.609486
## idCatholic 7342:poly(ses, 5, raw = TRUE)4  11.39751   12.87140   0.885 0.376015
## idCatholic 5761:poly(ses, 5, raw = TRUE)4   2.75688    9.24664   0.298 0.765625
## idCatholic 7172:poly(ses, 5, raw = TRUE)4  -0.57131   11.79243  -0.048 0.961365
## idCatholic 6074:poly(ses, 5, raw = TRUE)4   7.39742    9.13708   0.810 0.418279
## idCatholic 2629:poly(ses, 5, raw = TRUE)4  10.82398    9.43224   1.148 0.251312
## idCatholic 4511:poly(ses, 5, raw = TRUE)4   5.21888   11.70577   0.446 0.655770
## idCatholic 5650:poly(ses, 5, raw = TRUE)4   7.78400    9.04358   0.861 0.389510
## idCatholic 5720:poly(ses, 5, raw = TRUE)4   3.49359    9.79769   0.357 0.721455
## idCatholic 3610:poly(ses, 5, raw = TRUE)4   4.42257   11.68262   0.379 0.705061
## idCatholic 7688:poly(ses, 5, raw = TRUE)4   9.22890    9.68649   0.953 0.340844
## idCatholic 2458:poly(ses, 5, raw = TRUE)4  -3.10489   12.31769  -0.252 0.801019
## idCatholic 1317:poly(ses, 5, raw = TRUE)4   3.91973   10.38758   0.377 0.705962
## idCatholic 4868:poly(ses, 5, raw = TRUE)4  -6.01286   13.57990  -0.443 0.657982
## idCatholic 3992:poly(ses, 5, raw = TRUE)4   8.11942    9.38657   0.865 0.387156
## idCatholic 5619:poly(ses, 5, raw = TRUE)4   8.58868    9.74555   0.881 0.378282
## idCatholic 2208:poly(ses, 5, raw = TRUE)4  22.93040   14.83186   1.546 0.122281
## idCatholic 2658:poly(ses, 5, raw = TRUE)4   2.25041   11.72110   0.192 0.847767
## idCatholic 1906:poly(ses, 5, raw = TRUE)4  55.30213   41.92571   1.319 0.187326
## idCatholic 9586:poly(ses, 5, raw = TRUE)4   2.35025   18.96762   0.124 0.901402
## idPublic 5762:poly(ses, 5, raw = TRUE)4    63.99019   93.54877   0.684 0.494047
## idPublic 2639:poly(ses, 5, raw = TRUE)4   -24.79340   40.91048  -0.606 0.544567
## idPublic 8854:poly(ses, 5, raw = TRUE)4     0.72702   11.55326   0.063 0.949831
## idPublic 7890:poly(ses, 5, raw = TRUE)4    -7.01830   21.60605  -0.325 0.745348
## idPublic 8874:poly(ses, 5, raw = TRUE)4     3.10532   11.35498   0.273 0.784520
## idPublic 2771:poly(ses, 5, raw = TRUE)4    26.79790   33.61138   0.797 0.425394
## idPublic 6484:poly(ses, 5, raw = TRUE)4    -1.13716   10.07891  -0.113 0.910182
## idPublic 5640:poly(ses, 5, raw = TRUE)4    -5.84494   11.14187  -0.525 0.599934
## idPublic 7232:poly(ses, 5, raw = TRUE)4     3.96157    9.60044   0.413 0.679918
## idPublic 2626:poly(ses, 5, raw = TRUE)4    23.84722   17.60821   1.354 0.175809
## idPublic 3013:poly(ses, 5, raw = TRUE)4     8.03995   13.52996   0.594 0.552433
## idPublic 7345:poly(ses, 5, raw = TRUE)4     4.48427    9.13743   0.491 0.623659
## idPublic 9550:poly(ses, 5, raw = TRUE)4     2.99045    9.10313   0.329 0.742568
## idPublic 8627:poly(ses, 5, raw = TRUE)4     0.88294    9.06200   0.097 0.922393
## idPublic 8707:poly(ses, 5, raw = TRUE)4     6.19284    9.03646   0.685 0.493235
## idPublic 7697:poly(ses, 5, raw = TRUE)4    -5.73244   13.01483  -0.440 0.659663
## idPublic 6897:poly(ses, 5, raw = TRUE)4    10.54229   10.16662   1.037 0.299903
## idPublic 8531:poly(ses, 5, raw = TRUE)4    -1.11185   11.15639  -0.100 0.920626
## idPublic 7919:poly(ses, 5, raw = TRUE)4     4.16455   11.85925   0.351 0.725507
## idCatholic 4292:poly(ses, 5, raw = TRUE)5   3.64868    5.38176   0.678 0.497880
## idCatholic 7342:poly(ses, 5, raw = TRUE)5   6.14494    7.90416   0.777 0.437011
## idCatholic 5761:poly(ses, 5, raw = TRUE)5   2.33684    4.53562   0.515 0.606465
## idCatholic 7172:poly(ses, 5, raw = TRUE)5   1.77397    7.85271   0.226 0.821302
## idCatholic 6074:poly(ses, 5, raw = TRUE)5   3.01868    4.68994   0.644 0.519888
## idCatholic 2629:poly(ses, 5, raw = TRUE)5   4.98036    4.49789   1.107 0.268332
## idCatholic 4511:poly(ses, 5, raw = TRUE)5   4.31490   11.65922   0.370 0.711364
## idCatholic 5650:poly(ses, 5, raw = TRUE)5   6.96733    4.84550   1.438 0.150643
```

```
## idCatholic 5720:poly(ses, 5, raw = TRUE)5  10.21378    6.49268   1.573 0.115873
## idCatholic 3610:poly(ses, 5, raw = TRUE)5   6.57241    8.64821   0.760 0.447374
## idCatholic 7688:poly(ses, 5, raw = TRUE)5   2.29645    6.71477   0.342 0.732392
## idCatholic 2458:poly(ses, 5, raw = TRUE)5  10.77682    7.31500   1.473 0.140865
## idCatholic 1317:poly(ses, 5, raw = TRUE)5   6.09472    6.76286   0.901 0.367605
## idCatholic 4868:poly(ses, 5, raw = TRUE)5  14.33567    8.51260   1.684 0.092351
## idCatholic 3992:poly(ses, 5, raw = TRUE)5   5.14202    5.73551   0.897 0.370097
## idCatholic 5619:poly(ses, 5, raw = TRUE)5  -2.51017    5.64540  -0.445 0.656635
## idCatholic 2208:poly(ses, 5, raw = TRUE)5  -4.47185    7.17285  -0.623 0.533076
## idCatholic 2658:poly(ses, 5, raw = TRUE)5   5.66454    7.45727   0.760 0.447597
## idCatholic 1906:poly(ses, 5, raw = TRUE)5 -20.98976   17.50113  -1.199 0.230560
## idCatholic 9586:poly(ses, 5, raw = TRUE)5   5.71192    8.42596   0.678 0.497928
## idPublic 5762:poly(ses, 5, raw = TRUE)5    16.62739   18.43364   0.902 0.367175
## idPublic 2639:poly(ses, 5, raw = TRUE)5    -1.76596    9.45840  -0.187 0.851911
## idPublic 8854:poly(ses, 5, raw = TRUE)5     2.67037    4.74129   0.563 0.573360
## idPublic 7890:poly(ses, 5, raw = TRUE)5    -3.76864   10.21359  -0.369 0.712185
## idPublic 8874:poly(ses, 5, raw = TRUE)5     2.63870    4.33899   0.608 0.543176
## idPublic 2771:poly(ses, 5, raw = TRUE)5    16.72491   14.95358   1.118 0.263527
## idPublic 6484:poly(ses, 5, raw = TRUE)5    -4.97369    6.32389  -0.786 0.431686
## idPublic 5640:poly(ses, 5, raw = TRUE)5   -17.20297   11.31364  -1.521 0.128554
## idPublic 7232:poly(ses, 5, raw = TRUE)5     5.16115    6.85663   0.753 0.451717
## idPublic 2626:poly(ses, 5, raw = TRUE)5     4.88616   10.51908   0.465 0.642345
## idPublic 3013:poly(ses, 5, raw = TRUE)5     1.33257   22.10868   0.060 0.951945
## idPublic 7345:poly(ses, 5, raw = TRUE)5     2.72107    4.11727   0.661 0.508769
## idPublic 9550:poly(ses, 5, raw = TRUE)5     4.90985    4.96638   0.989 0.322988
## idPublic 8627:poly(ses, 5, raw = TRUE)5     0.04573    4.85547   0.009 0.992486
## idPublic 8707:poly(ses, 5, raw = TRUE)5     3.88279    4.76784   0.814 0.415544
## idPublic 7697:poly(ses, 5, raw = TRUE)5    16.93503    9.43748   1.794 0.072916
## idPublic 6897:poly(ses, 5, raw = TRUE)5    -0.03930    5.94405  -0.007 0.994725
## idPublic 8531:poly(ses, 5, raw = TRUE)5     5.86738    6.65586   0.882 0.378150
## idPublic 7919:poly(ses, 5, raw = TRUE)5    -5.75635   14.06326  -0.409 0.682356
##
## (Intercept)                               ***
## idCatholic 4292                           *
## idCatholic 7342
## idCatholic 5761
## idCatholic 7172
## idCatholic 6074                           **
## idCatholic 2629                           ***
## idCatholic 4511                           *
## idCatholic 5650                           ***
## idCatholic 5720                           .
## idCatholic 3610                           ***
## idCatholic 7688                           ***
## idCatholic 2458                           *
## idCatholic 1317                           *
## idCatholic 4868
## idCatholic 3992                           **
## idCatholic 5619                           ***
## idCatholic 2208                           **
## idCatholic 2658                           .
## idCatholic 1906                           **
## idCatholic 9586                           **
## idPublic 5762                             .
```

```
## idPublic 2639
## idPublic 8854
## idPublic 7890
## idPublic 8874                              .
## idPublic 2771                              *
## idPublic 6484
## idPublic 5640                              *
## idPublic 7232                              *
## idPublic 2626                              **
## idPublic 3013                              .
## idPublic 7345
## idPublic 9550
## idPublic 8627
## idPublic 8707                              .
## idPublic 7697                              .
## idPublic 6897                              **
## idPublic 8531
## idPublic 7919                              *
## poly(ses, 5, raw = TRUE)1
## poly(ses, 5, raw = TRUE)2
## poly(ses, 5, raw = TRUE)3
## poly(ses, 5, raw = TRUE)4
## poly(ses, 5, raw = TRUE)5
## idCatholic 4292:poly(ses, 5, raw = TRUE)1
## idCatholic 7342:poly(ses, 5, raw = TRUE)1
## idCatholic 5761:poly(ses, 5, raw = TRUE)1
## idCatholic 7172:poly(ses, 5, raw = TRUE)1
## idCatholic 6074:poly(ses, 5, raw = TRUE)1
## idCatholic 2629:poly(ses, 5, raw = TRUE)1
## idCatholic 4511:poly(ses, 5, raw = TRUE)1
## idCatholic 5650:poly(ses, 5, raw = TRUE)1
## idCatholic 5720:poly(ses, 5, raw = TRUE)1
## idCatholic 3610:poly(ses, 5, raw = TRUE)1
## idCatholic 7688:poly(ses, 5, raw = TRUE)1
## idCatholic 2458:poly(ses, 5, raw = TRUE)1
## idCatholic 1317:poly(ses, 5, raw = TRUE)1
## idCatholic 4868:poly(ses, 5, raw = TRUE)1
## idCatholic 3992:poly(ses, 5, raw = TRUE)1
## idCatholic 5619:poly(ses, 5, raw = TRUE)1
## idCatholic 2208:poly(ses, 5, raw = TRUE)1
## idCatholic 2658:poly(ses, 5, raw = TRUE)1
## idCatholic 1906:poly(ses, 5, raw = TRUE)1
## idCatholic 9586:poly(ses, 5, raw = TRUE)1
## idPublic 5762:poly(ses, 5, raw = TRUE)1
## idPublic 2639:poly(ses, 5, raw = TRUE)1
## idPublic 8854:poly(ses, 5, raw = TRUE)1
## idPublic 7890:poly(ses, 5, raw = TRUE)1
## idPublic 8874:poly(ses, 5, raw = TRUE)1
## idPublic 2771:poly(ses, 5, raw = TRUE)1
## idPublic 6484:poly(ses, 5, raw = TRUE)1
## idPublic 5640:poly(ses, 5, raw = TRUE)1
## idPublic 7232:poly(ses, 5, raw = TRUE)1
## idPublic 2626:poly(ses, 5, raw = TRUE)1
## idPublic 3013:poly(ses, 5, raw = TRUE)1
```

```
## idPublic 7345:poly(ses, 5, raw = TRUE)1
## idPublic 9550:poly(ses, 5, raw = TRUE)1
## idPublic 8627:poly(ses, 5, raw = TRUE)1
## idPublic 8707:poly(ses, 5, raw = TRUE)1
## idPublic 7697:poly(ses, 5, raw = TRUE)1
## idPublic 6897:poly(ses, 5, raw = TRUE)1
## idPublic 8531:poly(ses, 5, raw = TRUE)1
## idPublic 7919:poly(ses, 5, raw = TRUE)1
## idCatholic 4292:poly(ses, 5, raw = TRUE)2
## idCatholic 7342:poly(ses, 5, raw = TRUE)2
## idCatholic 5761:poly(ses, 5, raw = TRUE)2
## idCatholic 7172:poly(ses, 5, raw = TRUE)2
## idCatholic 6074:poly(ses, 5, raw = TRUE)2
## idCatholic 2629:poly(ses, 5, raw = TRUE)2
## idCatholic 4511:poly(ses, 5, raw = TRUE)2
## idCatholic 5650:poly(ses, 5, raw = TRUE)2
## idCatholic 5720:poly(ses, 5, raw = TRUE)2
## idCatholic 3610:poly(ses, 5, raw = TRUE)2
## idCatholic 7688:poly(ses, 5, raw = TRUE)2
## idCatholic 2458:poly(ses, 5, raw = TRUE)2
## idCatholic 1317:poly(ses, 5, raw = TRUE)2
## idCatholic 4868:poly(ses, 5, raw = TRUE)2
## idCatholic 3992:poly(ses, 5, raw = TRUE)2
## idCatholic 5619:poly(ses, 5, raw = TRUE)2
## idCatholic 2208:poly(ses, 5, raw = TRUE)2
## idCatholic 2658:poly(ses, 5, raw = TRUE)2
## idCatholic 1906:poly(ses, 5, raw = TRUE)2
## idCatholic 9586:poly(ses, 5, raw = TRUE)2
## idPublic 5762:poly(ses, 5, raw = TRUE)2
## idPublic 2639:poly(ses, 5, raw = TRUE)2
## idPublic 8854:poly(ses, 5, raw = TRUE)2
## idPublic 7890:poly(ses, 5, raw = TRUE)2
## idPublic 8874:poly(ses, 5, raw = TRUE)2
## idPublic 2771:poly(ses, 5, raw = TRUE)2
## idPublic 6484:poly(ses, 5, raw = TRUE)2
## idPublic 5640:poly(ses, 5, raw = TRUE)2
## idPublic 7232:poly(ses, 5, raw = TRUE)2
## idPublic 2626:poly(ses, 5, raw = TRUE)2
## idPublic 3013:poly(ses, 5, raw = TRUE)2
## idPublic 7345:poly(ses, 5, raw = TRUE)2
## idPublic 9550:poly(ses, 5, raw = TRUE)2
## idPublic 8627:poly(ses, 5, raw = TRUE)2
## idPublic 8707:poly(ses, 5, raw = TRUE)2
## idPublic 7697:poly(ses, 5, raw = TRUE)2
## idPublic 6897:poly(ses, 5, raw = TRUE)2
## idPublic 8531:poly(ses, 5, raw = TRUE)2
## idPublic 7919:poly(ses, 5, raw = TRUE)2
## idCatholic 4292:poly(ses, 5, raw = TRUE)3
## idCatholic 7342:poly(ses, 5, raw = TRUE)3
## idCatholic 5761:poly(ses, 5, raw = TRUE)3
## idCatholic 7172:poly(ses, 5, raw = TRUE)3
## idCatholic 6074:poly(ses, 5, raw = TRUE)3
## idCatholic 2629:poly(ses, 5, raw = TRUE)3
## idCatholic 4511:poly(ses, 5, raw = TRUE)3
```

```
## idCatholic 5650:poly(ses, 5, raw = TRUE)3 .
## idCatholic 5720:poly(ses, 5, raw = TRUE)3 *
## idCatholic 3610:poly(ses, 5, raw = TRUE)3
## idCatholic 7688:poly(ses, 5, raw = TRUE)3
## idCatholic 2458:poly(ses, 5, raw = TRUE)3
## idCatholic 1317:poly(ses, 5, raw = TRUE)3
## idCatholic 4868:poly(ses, 5, raw = TRUE)3 *
## idCatholic 3992:poly(ses, 5, raw = TRUE)3
## idCatholic 5619:poly(ses, 5, raw = TRUE)3
## idCatholic 2208:poly(ses, 5, raw = TRUE)3
## idCatholic 2658:poly(ses, 5, raw = TRUE)3
## idCatholic 1906:poly(ses, 5, raw = TRUE)3
## idCatholic 9586:poly(ses, 5, raw = TRUE)3
## idPublic 5762:poly(ses, 5, raw = TRUE)3
## idPublic 2639:poly(ses, 5, raw = TRUE)3
## idPublic 8854:poly(ses, 5, raw = TRUE)3
## idPublic 7890:poly(ses, 5, raw = TRUE)3
## idPublic 8874:poly(ses, 5, raw = TRUE)3
## idPublic 2771:poly(ses, 5, raw = TRUE)3
## idPublic 6484:poly(ses, 5, raw = TRUE)3
## idPublic 5640:poly(ses, 5, raw = TRUE)3
## idPublic 7232:poly(ses, 5, raw = TRUE)3
## idPublic 2626:poly(ses, 5, raw = TRUE)3
## idPublic 3013:poly(ses, 5, raw = TRUE)3
## idPublic 7345:poly(ses, 5, raw = TRUE)3
## idPublic 9550:poly(ses, 5, raw = TRUE)3
## idPublic 8627:poly(ses, 5, raw = TRUE)3
## idPublic 8707:poly(ses, 5, raw = TRUE)3
## idPublic 7697:poly(ses, 5, raw = TRUE)3   *
## idPublic 6897:poly(ses, 5, raw = TRUE)3
## idPublic 8531:poly(ses, 5, raw = TRUE)3
## idPublic 7919:poly(ses, 5, raw = TRUE)3
## idCatholic 4292:poly(ses, 5, raw = TRUE)4
## idCatholic 7342:poly(ses, 5, raw = TRUE)4
## idCatholic 5761:poly(ses, 5, raw = TRUE)4
## idCatholic 7172:poly(ses, 5, raw = TRUE)4
## idCatholic 6074:poly(ses, 5, raw = TRUE)4
## idCatholic 2629:poly(ses, 5, raw = TRUE)4
## idCatholic 4511:poly(ses, 5, raw = TRUE)4
## idCatholic 5650:poly(ses, 5, raw = TRUE)4
## idCatholic 5720:poly(ses, 5, raw = TRUE)4
## idCatholic 3610:poly(ses, 5, raw = TRUE)4
## idCatholic 7688:poly(ses, 5, raw = TRUE)4
## idCatholic 2458:poly(ses, 5, raw = TRUE)4
## idCatholic 1317:poly(ses, 5, raw = TRUE)4
## idCatholic 4868:poly(ses, 5, raw = TRUE)4
## idCatholic 3992:poly(ses, 5, raw = TRUE)4
## idCatholic 5619:poly(ses, 5, raw = TRUE)4
## idCatholic 2208:poly(ses, 5, raw = TRUE)4
## idCatholic 2658:poly(ses, 5, raw = TRUE)4
## idCatholic 1906:poly(ses, 5, raw = TRUE)4
## idCatholic 9586:poly(ses, 5, raw = TRUE)4
## idPublic 5762:poly(ses, 5, raw = TRUE)4
## idPublic 2639:poly(ses, 5, raw = TRUE)4
```

```
## idPublic 8854:poly(ses, 5, raw = TRUE)4
## idPublic 7890:poly(ses, 5, raw = TRUE)4
## idPublic 8874:poly(ses, 5, raw = TRUE)4
## idPublic 2771:poly(ses, 5, raw = TRUE)4
## idPublic 6484:poly(ses, 5, raw = TRUE)4
## idPublic 5640:poly(ses, 5, raw = TRUE)4
## idPublic 7232:poly(ses, 5, raw = TRUE)4
## idPublic 2626:poly(ses, 5, raw = TRUE)4
## idPublic 3013:poly(ses, 5, raw = TRUE)4
## idPublic 7345:poly(ses, 5, raw = TRUE)4
## idPublic 9550:poly(ses, 5, raw = TRUE)4
## idPublic 8627:poly(ses, 5, raw = TRUE)4
## idPublic 8707:poly(ses, 5, raw = TRUE)4
## idPublic 7697:poly(ses, 5, raw = TRUE)4
## idPublic 6897:poly(ses, 5, raw = TRUE)4
## idPublic 8531:poly(ses, 5, raw = TRUE)4
## idPublic 7919:poly(ses, 5, raw = TRUE)4
## idCatholic 4292:poly(ses, 5, raw = TRUE)5
## idCatholic 7342:poly(ses, 5, raw = TRUE)5
## idCatholic 5761:poly(ses, 5, raw = TRUE)5
## idCatholic 7172:poly(ses, 5, raw = TRUE)5
## idCatholic 6074:poly(ses, 5, raw = TRUE)5
## idCatholic 2629:poly(ses, 5, raw = TRUE)5
## idCatholic 4511:poly(ses, 5, raw = TRUE)5
## idCatholic 5650:poly(ses, 5, raw = TRUE)5
## idCatholic 5720:poly(ses, 5, raw = TRUE)5
## idCatholic 3610:poly(ses, 5, raw = TRUE)5
## idCatholic 7688:poly(ses, 5, raw = TRUE)5
## idCatholic 2458:poly(ses, 5, raw = TRUE)5
## idCatholic 1317:poly(ses, 5, raw = TRUE)5
## idCatholic 4868:poly(ses, 5, raw = TRUE)5 .
## idCatholic 3992:poly(ses, 5, raw = TRUE)5
## idCatholic 5619:poly(ses, 5, raw = TRUE)5
## idCatholic 2208:poly(ses, 5, raw = TRUE)5
## idCatholic 2658:poly(ses, 5, raw = TRUE)5
## idCatholic 1906:poly(ses, 5, raw = TRUE)5
## idCatholic 9586:poly(ses, 5, raw = TRUE)5
## idPublic 5762:poly(ses, 5, raw = TRUE)5
## idPublic 2639:poly(ses, 5, raw = TRUE)5
## idPublic 8854:poly(ses, 5, raw = TRUE)5
## idPublic 7890:poly(ses, 5, raw = TRUE)5
## idPublic 8874:poly(ses, 5, raw = TRUE)5
## idPublic 2771:poly(ses, 5, raw = TRUE)5
## idPublic 6484:poly(ses, 5, raw = TRUE)5
## idPublic 5640:poly(ses, 5, raw = TRUE)5
## idPublic 7232:poly(ses, 5, raw = TRUE)5
## idPublic 2626:poly(ses, 5, raw = TRUE)5
## idPublic 3013:poly(ses, 5, raw = TRUE)5
## idPublic 7345:poly(ses, 5, raw = TRUE)5
## idPublic 9550:poly(ses, 5, raw = TRUE)5
## idPublic 8627:poly(ses, 5, raw = TRUE)5
## idPublic 8707:poly(ses, 5, raw = TRUE)5
## idPublic 7697:poly(ses, 5, raw = TRUE)5   .
## idPublic 6897:poly(ses, 5, raw = TRUE)5
```

```
## idPublic 8531:poly(ses, 5, raw = TRUE)5
## idPublic 7919:poly(ses, 5, raw = TRUE)5
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.119 on 1737 degrees of freedom
## Multiple R-squared:  0.2959, Adjusted R-squared:  0.1991
## F-statistic: 3.055 on 239 and 1737 DF,  p-value: < 2.2e-16
```

```
pred$fit2 <- predict(fit2, newdata = pred)  # we can use 'pred' since it's the same predictors

xyplot(mathach ~ ses | id, hsm , groups = Sex,
       # skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(7,6),                # breaks convention
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.6),
       auto.key = list(space = 'right', lines = T))  +
  xyplot(fit ~ ses | id, pred,  type = 'l', col = 'black')+
  xyplot(fit2 ~ ses | id, pred, type = 'l', col = 'blue')

anova(fit, fit2)
```

```
## Analysis of Variance Table
##
## Model 1: mathach ~ id * (ses + I(ses^2)) - 1
## Model 2: mathach ~ id * poly(ses, 5, raw = TRUE)
##   Res.Df   RSS  Df Sum of Sq      F Pr(>F)
## 1   1857 69179
## 2   1737 65044 120    4135.7 0.9204 0.7174
```

```
#
# Importing information from hs into a prediction data frame
#
# Suppose you also wanted each school's Sector in the 'pred'
# data frame.
#
# You can't use:
#
pred_bad <- with(hsm, pred.grid(id, Sector, ses = seq(-3,3,.01)))
#
# Why not??
#
# Here's an easy way with the 'up' function
#
pred <- with(hsm, pred.grid(id, ses = seq(-3,3,.01)))   # as before
dim(pred)
```

```
## [1] 24040     2
```

```
head(pred)
```

```
##              id ses
## 1 Catholic 1317  -3
## 2 Catholic 1906  -3
## 3 Catholic 2208  -3
## 4 Catholic 2458  -3
```

```
## 5   Public 2626  -3
## 6 Catholic 2629  -3
```

```
#
#  Merge with Sector and other Level-2 variables
#
pred <- merge(pred, up(hsm, ~id), by = 'id', all.x = TRUE)   # left join
dim(pred)                 # same number of rows
```

```
## [1] 24040     9
```

```
head(pred)                # extra variables
```

```
##              id   ses school Size   Sector PRACAD DISCLIM           id1 Freq
## 1 Catholic 1317 -3.00   1317  455 Catholic   0.95  -1.694 Catholic 1317   48
## 2 Catholic 1317 -2.18   1317  455 Catholic   0.95  -1.694 Catholic 1317   48
## 3 Catholic 1317 -1.36   1317  455 Catholic   0.95  -1.694 Catholic 1317   48
## 4 Catholic 1317 -0.54   1317  455 Catholic   0.95  -1.694 Catholic 1317   48
## 5 Catholic 1317  0.28   1317  455 Catholic   0.95  -1.694 Catholic 1317   48
## 6 Catholic 1317  1.10   1317  455 Catholic   0.95  -1.694 Catholic 1317   48
```

```
#
# Now we use predicted lines for models that use Sector
#
fit3 <- lm(mathach ~ poly(ses,2,raw=TRUE) * Sector ,  hs)
pred$fit3 <- predict(fit3, newdata = pred)
pred <- sortdf(pred, ~ ses)
xyplot(mathach ~ ses | id, hsm , groups = Sex,
       # skip = rep(c(F,T,F), c(21,3,30)),
       layout = c(7,6),
       between = list(y =c(0,0,.3,0,0,0)),
       par.strip.text = list(cex=.6),
       auto.key = list(space = 'right', lines = T))  +
  xyplot(fit3 ~ ses | id, pred,  type = 'l', col = 'blue', lwd = 2)


# Exercise:
#
# - Plot fitted lines for models that use Sector and Sex
# - Experiment with a variety of models and presentations
```

Add plotting ideas and tricks to Piazza