Human Classification Data

Shane T. Mueller shanem@mtu.edu

September 28 2017

```
class.dat <- file_merge("../Data/",has_header=T,
                  file_name="classify.txt",
                  raw_file_extension="csv",
                  raw_file_name = "classify")

pred.dat <-  file_merge("../Data/",has_header=T,
                  file_name="prediction.txt",
                  raw_file_extension="csv",
                  raw_file_name = "prediction")
```

First, I will just read in the data that I pooled previously. The pred.dat file had a bad header, so to make it easy if we add data, I am replacing it here. At the bottom, I'll make sure we don't have any duplicate participant codes. We can see that all but 1001 did 360/12 trials.

```
class.dat <- read.csv("../Human_data/class-pooled.csv")

pred.dat <- read.csv("../Human_data/pred-pooled.csv",skip=1)
colnames(pred.dat) <- c("subnum","trial","set","time","imgset","rating","D1.1","D1.2","D1.3","D1.4","D1

table(class.dat$subnum)
```

```
##
## 1001 1002 1003 1004 1005 1006 1007 2001 2002 2003 2004 2005 2006 2007 2008
##  180  360  360  360  390  390  390  360  360  360  360  360  390  390  390
## 3001 3002 3003 3004 3005 3006 3007 4001 4002 4003 4004 4006 4007 5001 5002
##  360  360  360  360  390  390  390  360  360  360  360  390  390  360  360
## 5003 5004 5005 5006 5007 5008 6001 6002 6003 6004 6005 6006 6007 6008 7001
##  360  360  390  390  390  390  360  360  360  360  390  390  390  390  360
## 7002 7003 8001 8002 8003
##  360  360  360  360  360
```

```
table(pred.dat$subnum)
```

```
##
## 1001 1002 1003 1004 1005 1006 1007 2001 2002 2003 2004 2005 2006 2007 2008
##    6   12   12   12   13   13   13   12   12   12   12   12   13   13   13
## 3001 3002 3003 3004 3005 3006 3007 4001 4002 4003 4004 4006 4007 5001 5002
##   12   12   12   12   13   13   13   12   12   12   12   13   13   12   12
## 5003 5004 5005 5006 5007 5008 6001 6002 6003 6004 6005 6006 6007 6008 7001
##   12   12   13   12   13   13   12   12   12   12   13   13   13   13   12
## 7002 7003 8001 8002 8003
##   12   12   12   12   12
```

```
##this reads in the AI output accuracies
ai.dat <- read.csv("../Human_data/summaries.csv")
```

Now, I want to check the scoring. Were people making specific errors? How about specific confusions? The following looks at the 20 worst images overall:

```r
byimg<-aggregate(class.dat$corr,list(class.dat$imgname),mean)
byimg[order(byimg$x),][1:20,]
```

```
##                                             Group.1         x
## 80        Transformed-Images/BW-Tools/scissor5.jpg 0.2592593
## 367    Transformed-Images/Implode-Tools/plier2.jpg 0.5000000
## 617      Transformed-Images/Shear-Tools/plier2.jpg 0.5000000
## 117    Transformed-Images/Charcol-Tools/plier2.jpg 0.5600000
## 17        Transformed-Images/Blur-Tools/plier2.jpg 0.6315789
## 167       Transformed-Images/Edge-Tools/plier2.jpg 0.6363636
## 517           Transformed-Images/Resize/plier2.jpg 0.6428571
## 217 Transformed-Images/Edge-White-Tools/plier2.jpg 0.6538462
## 296    Transformed-Images/Frame-Leaves/wrench1.jpg 0.6923077
## 796      Transformed-Images/Wave-Tools/wrench1.jpg 0.6923077
## 417   Transformed-Images/Original-Tools/plier2.jpg 0.7192982
## 767       Transformed-Images/Wave-Tools/plier2.jpg 0.7272727
## 717           Transformed-Images/Splice/plier2.jpg 0.7407407
## 67          Transformed-Images/BW-Tools/plier2.jpg 0.7500000
## 317     Transformed-Images/Frame-Nature/plier2.jpg 0.7500000
## 364   Transformed-Images/Implode-Tools/hammer4.jpg 0.7500000
## 87         Transformed-Images/BW-Tools/shovel2.jpg 0.7777778
## 267     Transformed-Images/Frame-Leaves/plier2.jpg 0.7777778
## 496   Transformed-Images/Rainbow-Tools/wrench1.jpg 0.7777778
## 646     Transformed-Images/Shear-Tools/wrench1.jpg 0.7916667
```

I looked as bw-tools/scissor5, and this was a very bad transform that just caught a snippet of the image. Most of the rest of the bad ones were plier2, which is a channel-lock that may have gotten named as a wrench. When we get through this, accuracy is about 80% or higher for all remaining imagery.

To see what is maybe going on, I'll look at the confusion matrix, both for classes and for specific images. This time, ignoring the transform.

```r
class.dat$baseimg2 <- sapply(class.dat$img,function(x){strsplit(as.character(x),"/")[[1]][[3]]})

classtab <- table(given=class.dat$baseimg,response=class.dat$resp)

sum(classtab[upper.tri(classtab)])
```

```
## [1] 212
```

```r
sum(classtab[upper.tri(classtab) | diag(classtab)])
```

```
## [1] 18390
```

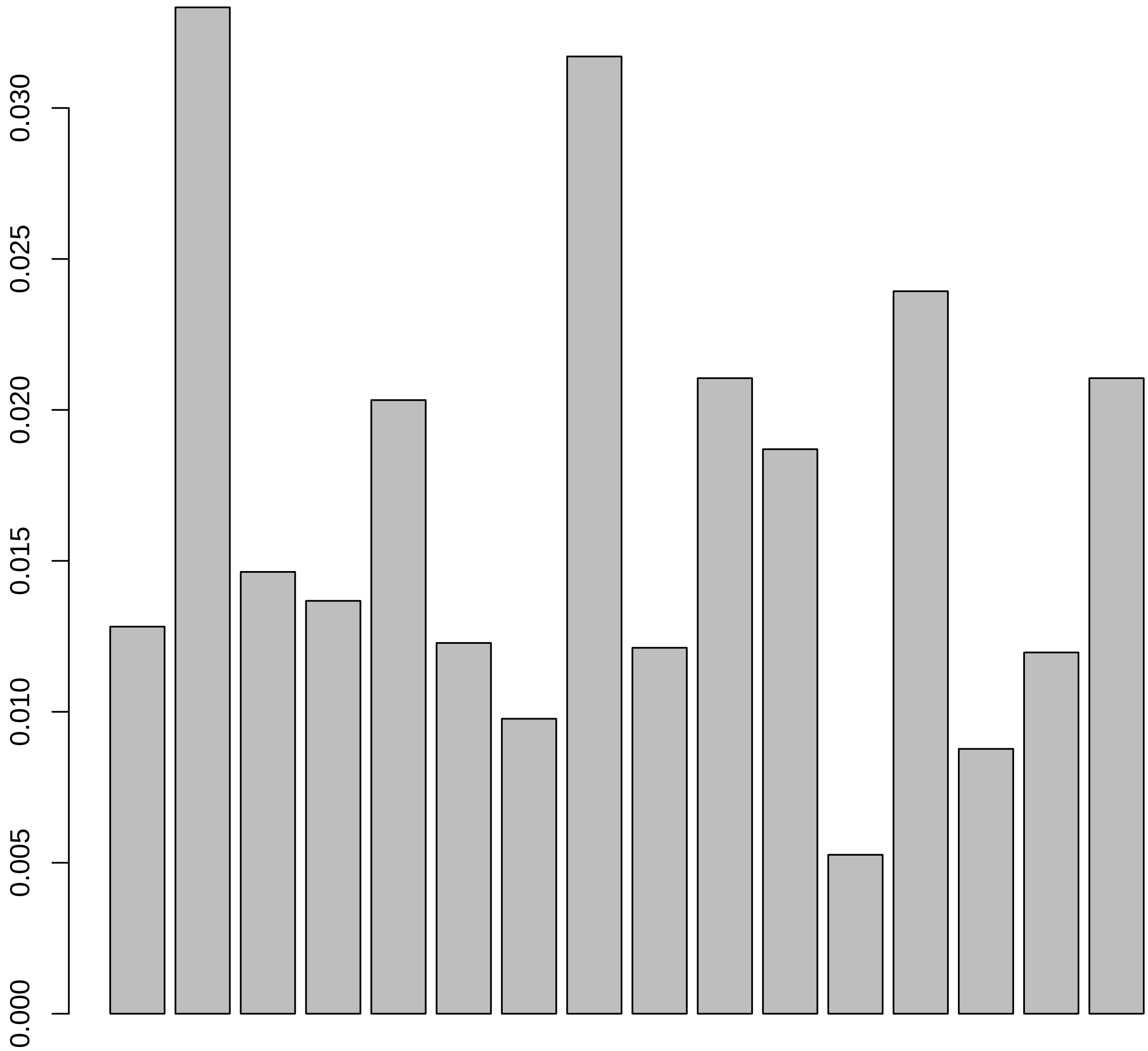
```r
table(given=class.dat$baseimg2,response=class.dat$resp)
```

```
##                 response
## given            axe flash hammer plier saw scissor screw shovel tape wrench
##   axe1.jpg       341     0     17     0   0       0     0      1    0      0
##   axe2.jpg       375     0      3     0   0       0     0      1    0      0
##   axe3.jpg       358     0      6     0   4       0     0      0    0      0
##   axe4.jpg       356     0      3     0   0       0     0      0    0      0
##   axe5.jpg       369     0      4     0   1       0     0      0    0      0
##   flash1.jpg       0   368      0     0   1       0     0      0    0      0
##   flash2.jpg       0   359      0     0   0       0     0      0    0      0
##   flash3.jpg       0   392      0     0   0       0     0      0    0      0
##   flash4.jpg       0   349      0     0   0       0     0      0    0      0
```

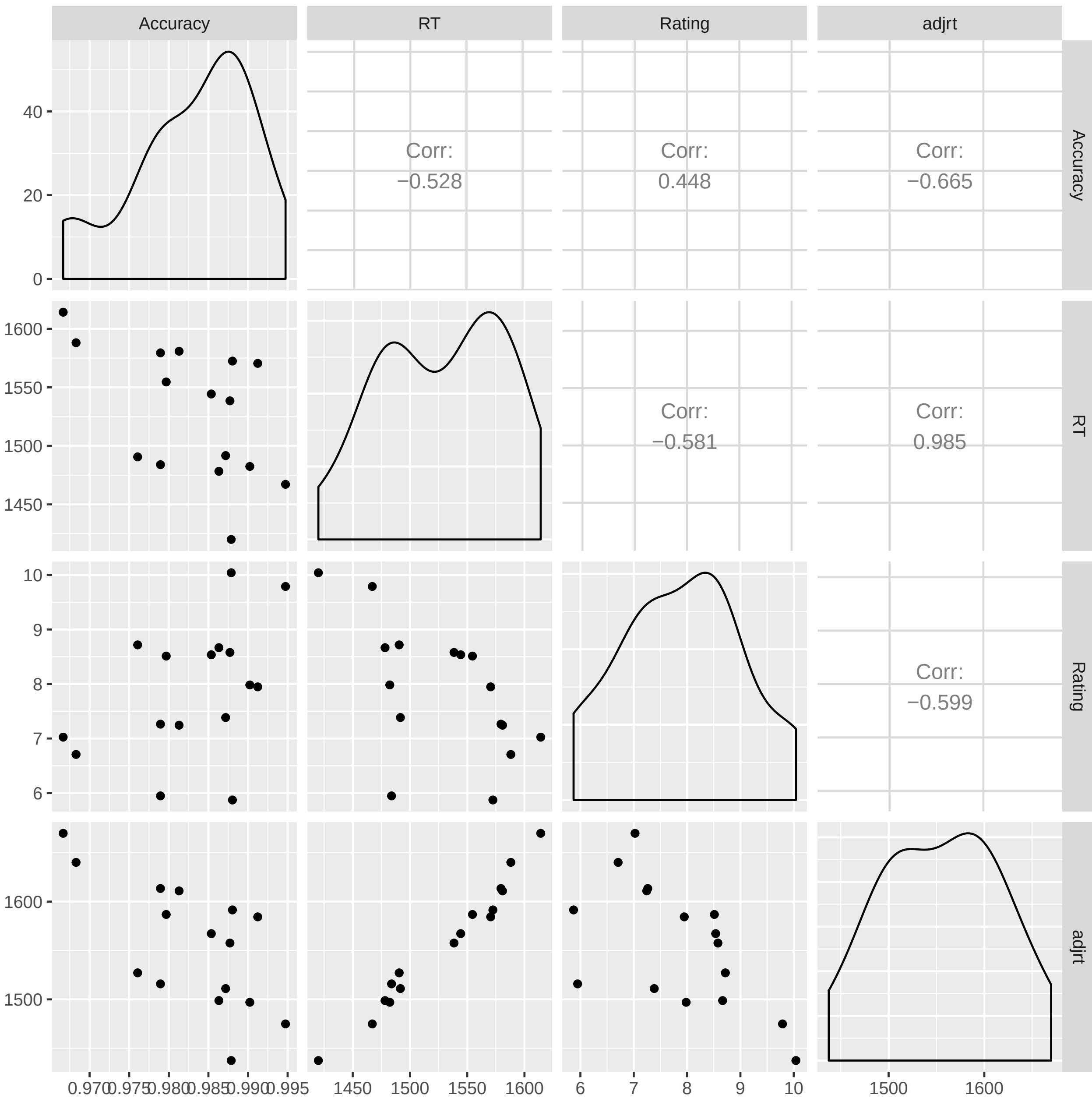
```
##    flash5.jpg     1   368      0    1    0      0      0      0    0      0
##    hammer1.jpg    5     0    357    0    1      0      2      0    0      1
##    hammer2.jpg    2     0    372    2    6      0      0      0    1      0
##    hammer3.jpg    0     1    363    0    0      0      0      0    0      0
##    hammer4.jpg    3     0    349    0    0      0      0      5    0      0
##    hammer5.jpg    0     0    369    0    0      0      0      0    0      0
##    plier1.jpg     0     0      0  361    0      0      0      0    0      3
##    plier2.jpg     0     0      0  245    0      0      0      0    0    113
##    plier3.jpg     0     0      0  344    0     10      0      0    0      0
##    plier4.jpg     0     1      0  386    0      0      0      0    0      1
##    plier5.jpg     0     0      0  373    0      1      0      0    0      1
##    saw1.jpg       0     0      0    0  376      0      0      1    0      0
##    saw2.jpg       0     0      0    0  357      1      0      0    1      1
##    saw3.jpg       3     1      4    0  340      1      1      0    0      0
##    saw4.jpg       1     0      0    1  377      0      1      0    0      0
##    saw5.jpg       0     0      0    0  370      1      0      0    1      0
##    scissor1.jpg   0     0      0    1    0    370      1      0    0      0
##    scissor2.jpg   0     0      0    2    0    368      0      0    0      0
##    scissor3.jpg   0     0      0    2    0    358      1      0    0      0
##    scissor4.jpg   0     0      0    0    0    371      0      0    0      0
##    scissor5.jpg   0     1      0    6    2    345      5      0    4      2
##    screw1.jpg     0     0      0    0    0      0    382      0    0      0
##    screw2.jpg     0     0      0    0    0      1    372      0    0      0
##    screw3.jpg     0     0      0    0    0      0    349      0    0      0
##    screw4.jpg     1     0      0    0    0      0    336      0    0      0
##    screw5.jpg     0     0      0    0    0      1    397      0    0      0
##    shovel1.jpg    1     0      0    0    0      0      0    368    0      0
##    shovel2.jpg    0     0      0    6    0      0      0    360    0      1
##    shovel3.jpg    0     0      0    1    1      0      0    392    0      0
##    shovel4.jpg    0     0      1    0    0      0      0    353    0      0
##    shovel5.jpg    0     0      0    0    0      0      0    355    0      0
##    tape1.jpg      0     0      0    0    0      0      0      0  372      0
##    tape2.jpg      0     0      0    0    0      0      0      0  359      0
##    tape3.jpg      0     0      0    0    0      0      0      0  376      0
##    tape4.jpg      0     0      0    0    0      0      0      0  370      0
##    tape5.jpg      0     0      0    0    0      0      0      0  362      0
##    wrench1.jpg    0     0      0   44    0      0      1      0    2    313
##    wrench2.jpg    0     0      0    1    0      0      0      0    0    362
##    wrench3.jpg    0     0      0    1    0      0      0      0    0    382
##    wrench4.jpg    0     0      0    0    0      0      0      0    0    359
##    wrench5.jpg    0     0      0    0    0      0      0      0    0    374
```

The errors for plier2 wer calling it wrench;

```
class.agg <- aggregate(class.dat$corr,list(class.dat$transform),mean)
class.agg$rt <-aggregate(class.dat$rt,list(class.dat$transform),mean)$x
barplot(1-class.agg$x)

pred.agg <-  aggregate(pred.dat$rating,list(pred.dat$imgset),mean)

library(GGally)
```




```
tmp <- data.frame(class=substr(class.agg$Group.1,20,
                               nchar(as.character(class.agg$Group.1))-1),

                  Accuracy=class.agg$x,
                  RT=class.agg$rt,
                  Rating=pred.agg$x)
tmp$adjrt <- tmp$RT/tmp$Accuracy
rownames(tmp) <- tmp$class
ggpairs(tmp[,-1])
```



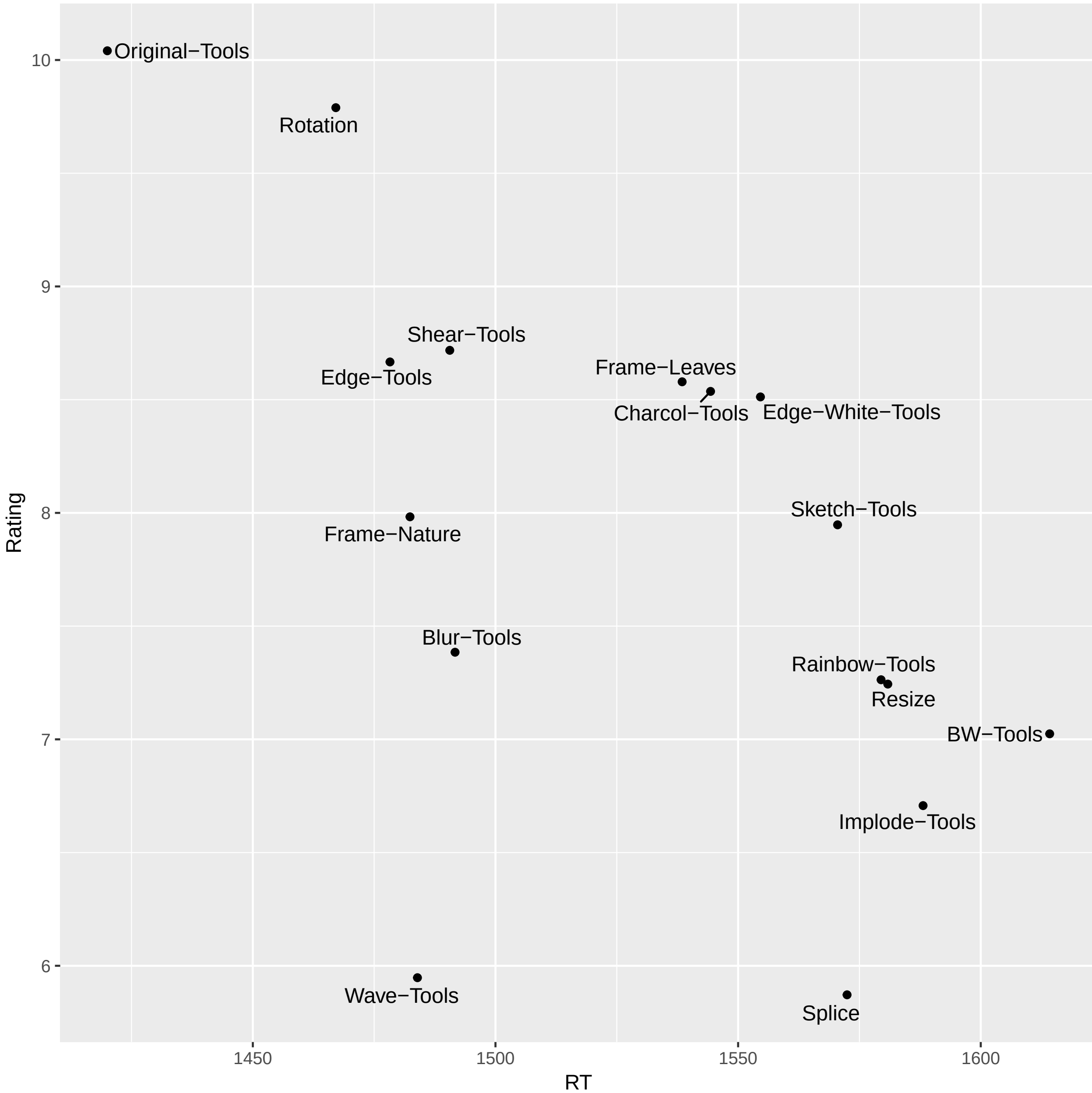
Let's label these:

```
library(BayesFactor)
```

```
## Loading required package: coda

## Loading required package: Matrix

## ************
## Welcome to BayesFactor 0.9.12-4.2. If you have questions, please contact Richard Morey (richarddmorey
##
## Type BFManual() to open the manual.
## ************
```

```
library(ggplot2)
library(ggrepel)
```

```r
ggplot(tmp,aes(x=RT,y=Rating,label=class)) + geom_point() + geom_text_repel()
```




```r
correlationBF(tmp$RT,tmp$Rating)
```

```
## Bayes factor analysis
## --------------
## [1] Alt., r=0.333 : 4.113791 ±0%
##
## Against denominator:
##   Null, rho = 0
## ---
## Bayes factor type: BFcorrelation, Jeffreys-beta*
```

```r
model1 <- glm(corr~0+as.factor(subnum)+transform+baseimg2,data=class.dat)
summary(model1)
```

```
##
## Call:
## glm(formula = corr ~ 0 + as.factor(subnum) + transform + baseimg2,
##     data = class.dat)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -1.01074  -0.00385   0.00543   0.01875   0.35578
##
## Coefficients:
##                                                Estimate Std. Error
## as.factor(subnum)1001                         0.9163731  0.0115902
## as.factor(subnum)1002                         0.9450367  0.0094886
## as.factor(subnum)1003                         0.9532741  0.0095237
## as.factor(subnum)1004                         0.9505914  0.0095478
## as.factor(subnum)1005                         0.9648883  0.0095612
## as.factor(subnum)1006                         0.9619550  0.0095180
## as.factor(subnum)1007                         0.9501641  0.0095077
## as.factor(subnum)2001                         0.9555557  0.0095124
## as.factor(subnum)2002                         0.9465844  0.0095241
## as.factor(subnum)2003                         0.9513949  0.0095128
## as.factor(subnum)2004                         0.9553536  0.0095231
## as.factor(subnum)2005                         0.9561775  0.0095356
## as.factor(subnum)2006                         0.9613482  0.0093988
## as.factor(subnum)2007                         0.9678772  0.0094961
## as.factor(subnum)2008                         0.9591957  0.0094843
## as.factor(subnum)3001                         0.9639901  0.0094644
## as.factor(subnum)3002                         0.9663413  0.0095001
## as.factor(subnum)3003                         0.9574836  0.0094889
## as.factor(subnum)3004                         0.9664857  0.0094888
## as.factor(subnum)3005                         0.9481595  0.0094008
## as.factor(subnum)3006                         0.9481593  0.0093887
## as.factor(subnum)3007                         0.9556073  0.0094343
## as.factor(subnum)4001                         0.9510695  0.0095233
## as.factor(subnum)4002                         0.9458527  0.0095348
## as.factor(subnum)4003                         0.9468326  0.0095354
## as.factor(subnum)4004                         0.9433049  0.0095229
## as.factor(subnum)4006                         0.9382259  0.0095288
## as.factor(subnum)4007                         0.9537832  0.0094114
## as.factor(subnum)5001                         0.9489754  0.0094535
## as.factor(subnum)5002                         0.9287561  0.0095113
## as.factor(subnum)5003                         0.9633553  0.0095340
## as.factor(subnum)5004                         0.9686373  0.0095002
## as.factor(subnum)5005                         0.9535318  0.0094965
## as.factor(subnum)5006                         0.9698434  0.0095063
## as.factor(subnum)5007                         0.9476107  0.0094007
## as.factor(subnum)5008                         0.9453212  0.0094849
## as.factor(subnum)6001                         0.9510297  0.0094767
## as.factor(subnum)6002                         0.9514844  0.0094770
## as.factor(subnum)6003                         0.9424365  0.0095235
## as.factor(subnum)6004                         0.9567946  0.0095127
## as.factor(subnum)6005                         0.9660215  0.0093778
## as.factor(subnum)6006                         0.9604607  0.0094338
## as.factor(subnum)6007                         0.9519434  0.0094959
```

```
## as.factor(subnum)6008                          0.9643023  0.0094112
## as.factor(subnum)7001                          0.9544925  0.0095007
## as.factor(subnum)7002                          0.9386428  0.0095111
## as.factor(subnum)7003                          0.9350157  0.0095228
## as.factor(subnum)8001                          0.9576205  0.0094890
## as.factor(subnum)8002                          0.9591490  0.0095468
## as.factor(subnum)8003                          0.9570901  0.0095586
## transformTransformed-Images/BW-Tools/         -0.0195312  0.0049508
## transformTransformed-Images/Charcol-Tools/     0.0003936  0.0049505
## transformTransformed-Images/Edge-Tools/       -0.0009368  0.0049574
## transformTransformed-Images/Edge-White-Tools/ -0.0061826  0.0049511
## transformTransformed-Images/Frame-Leaves/     -0.0023745  0.0063542
## transformTransformed-Images/Frame-Nature/      0.0021274  0.0045665
## transformTransformed-Images/Implode-Tools/    -0.0173415  0.0049506
## transformTransformed-Images/Original-Tools/    0.0009093  0.0041686
## transformTransformed-Images/Rainbow-Tools/    -0.0103171  0.0063538
## transformTransformed-Images/Resize/           -0.0034802  0.0049509
## transformTransformed-Images/Rotation/          0.0033523  0.0063538
## transformTransformed-Images/Shear-Tools/      -0.0108300  0.0049566
## transformTransformed-Images/Sketch-Tools/      0.0023549  0.0063547
## transformTransformed-Images/Splice/            0.0018442  0.0049574
## transformTransformed-Images/Wave-Tools/       -0.0100531  0.0063536
## baseimg2axe2.jpg                               0.0394182  0.0088332
## baseimg2axe3.jpg                               0.0228677  0.0088994
## baseimg2axe4.jpg                               0.0425923  0.0089554
## baseimg2axe5.jpg                               0.0373863  0.0088632
## baseimg2flash1.jpg                             0.0478941  0.0088901
## baseimg2flash2.jpg                             0.0501773  0.0089522
## baseimg2flash3.jpg                             0.0499284  0.0087619
## baseimg2flash4.jpg                             0.0506614  0.0090155
## baseimg2flash5.jpg                             0.0451043  0.0088851
## baseimg2hammer1.jpg                            0.0260392  0.0089098
## baseimg2hammer2.jpg                            0.0219135  0.0088108
## baseimg2hammer3.jpg                            0.0472723  0.0089196
## baseimg2hammer4.jpg                            0.0274083  0.0089632
## baseimg2hammer5.jpg                            0.0507123  0.0088896
## baseimg2plier1.jpg                             0.0426136  0.0089198
## baseimg2plier2.jpg                            -0.2650026  0.0089564
## baseimg2plier3.jpg                             0.0216449  0.0089831
## baseimg2plier4.jpg                             0.0449109  0.0087817
## baseimg2plier5.jpg                             0.0450662  0.0088579
## baseimg2saw1.jpg                               0.0479882  0.0088440
## baseimg2saw2.jpg                               0.0423507  0.0089437
## baseimg2saw3.jpg                               0.0218054  0.0090104
## baseimg2saw4.jpg                               0.0420969  0.0088271
## baseimg2saw5.jpg                               0.0447887  0.0088731
## baseimg2scissor1.jpg                           0.0449383  0.0088728
## baseimg2scissor2.jpg                           0.0451198  0.0088832
## baseimg2scissor3.jpg                           0.0421071  0.0089386
## baseimg2scissor4.jpg                           0.0503224  0.0088787
## baseimg2scissor5.jpg                          -0.0045306  0.0089157
## baseimg2screw1.jpg                             0.0502386  0.0088154
## baseimg2screw2.jpg                             0.0478918  0.0088677
## baseimg2screw3.jpg                             0.0503224  0.0090132
```

```
## baseimg2screw4.jpg                               0.0473338  0.0090980
## baseimg2screw5.jpg                               0.0478873  0.0087290
## baseimg2shovel1.jpg                              0.0466814  0.0088909
## baseimg2shovel2.jpg                              0.0311002  0.0089036
## baseimg2shovel3.jpg                              0.0454217  0.0087490
## baseimg2shovel4.jpg                              0.0486867  0.0089823
## baseimg2shovel5.jpg                              0.0503028  0.0089763
## baseimg2tape1.jpg                                0.0506155  0.0088727
## baseimg2tape2.jpg                                0.0498661  0.0089516
## baseimg2tape3.jpg                                0.0505513  0.0088503
## baseimg2tape4.jpg                                0.0504864  0.0088840
## baseimg2tape5.jpg                                0.0503033  0.0089334
## baseimg2wrench1.jpg                             -0.0802263  0.0089454
## baseimg2wrench2.jpg                              0.0483267  0.0089266
## baseimg2wrench3.jpg                              0.0475845  0.0088087
## baseimg2wrench4.jpg                              0.0501429  0.0089525
## baseimg2wrench5.jpg                              0.0501087  0.0088633
##                                                 t value Pr(>|t|)
## as.factor(subnum)1001                             79.065  < 2e-16 ***
## as.factor(subnum)1002                             99.597  < 2e-16 ***
## as.factor(subnum)1003                            100.095  < 2e-16 ***
## as.factor(subnum)1004                             99.562  < 2e-16 ***
## as.factor(subnum)1005                            100.918  < 2e-16 ***
## as.factor(subnum)1006                            101.067  < 2e-16 ***
## as.factor(subnum)1007                             99.936  < 2e-16 ***
## as.factor(subnum)2001                            100.454  < 2e-16 ***
## as.factor(subnum)2002                             99.388  < 2e-16 ***
## as.factor(subnum)2003                            100.013  < 2e-16 ***
## as.factor(subnum)2004                            100.319  < 2e-16 ***
## as.factor(subnum)2005                            100.274  < 2e-16 ***
## as.factor(subnum)2006                            102.284  < 2e-16 ***
## as.factor(subnum)2007                            101.924  < 2e-16 ***
## as.factor(subnum)2008                            101.136  < 2e-16 ***
## as.factor(subnum)3001                            101.855  < 2e-16 ***
## as.factor(subnum)3002                            101.719  < 2e-16 ***
## as.factor(subnum)3003                            100.905  < 2e-16 ***
## as.factor(subnum)3004                            101.855  < 2e-16 ***
## as.factor(subnum)3005                            100.860  < 2e-16 ***
## as.factor(subnum)3006                            100.990  < 2e-16 ***
## as.factor(subnum)3007                            101.291  < 2e-16 ***
## as.factor(subnum)4001                             99.868  < 2e-16 ***
## as.factor(subnum)4002                             99.200  < 2e-16 ***
## as.factor(subnum)4003                             99.297  < 2e-16 ***
## as.factor(subnum)4004                             99.056  < 2e-16 ***
## as.factor(subnum)4006                             98.462  < 2e-16 ***
## as.factor(subnum)4007                            101.343  < 2e-16 ***
## as.factor(subnum)5001                            100.384  < 2e-16 ***
## as.factor(subnum)5002                             97.647  < 2e-16 ***
## as.factor(subnum)5003                            101.045  < 2e-16 ***
## as.factor(subnum)5004                            101.960  < 2e-16 ***
## as.factor(subnum)5005                            100.409  < 2e-16 ***
## as.factor(subnum)5006                            102.021  < 2e-16 ***
## as.factor(subnum)5007                            100.802  < 2e-16 ***
## as.factor(subnum)5008                             99.666  < 2e-16 ***
```

```
## as.factor(subnum)6001                            100.354  < 2e-16 ***
## as.factor(subnum)6002                            100.399  < 2e-16 ***
## as.factor(subnum)6003                             98.959  < 2e-16 ***
## as.factor(subnum)6004                            100.581  < 2e-16 ***
## as.factor(subnum)6005                            103.012  < 2e-16 ***
## as.factor(subnum)6006                            101.811  < 2e-16 ***
## as.factor(subnum)6007                            100.248  < 2e-16 ***
## as.factor(subnum)6008                            102.463  < 2e-16 ***
## as.factor(subnum)7001                            100.466  < 2e-16 ***
## as.factor(subnum)7002                             98.690  < 2e-16 ***
## as.factor(subnum)7003                             98.187  < 2e-16 ***
## as.factor(subnum)8001                            100.919  < 2e-16 ***
## as.factor(subnum)8002                            100.468  < 2e-16 ***
## as.factor(subnum)8003                            100.128  < 2e-16 ***
## transformTransformed-Images/BW-Tools/             -3.945 8.01e-05 ***
## transformTransformed-Images/Charcol-Tools/         0.080 0.936623
## transformTransformed-Images/Edge-Tools/           -0.189 0.850123
## transformTransformed-Images/Edge-White-Tools/     -1.249 0.211776
## transformTransformed-Images/Frame-Leaves/         -0.374 0.708645
## transformTransformed-Images/Frame-Nature/          0.466 0.641313
## transformTransformed-Images/Implode-Tools/        -3.503 0.000461 ***
## transformTransformed-Images/Original-Tools/        0.218 0.827324
## transformTransformed-Images/Rainbow-Tools/        -1.624 0.104444
## transformTransformed-Images/Resize/               -0.703 0.482106
## transformTransformed-Images/Rotation/              0.528 0.597776
## transformTransformed-Images/Shear-Tools/          -2.185 0.028905 *
## transformTransformed-Images/Sketch-Tools/          0.371 0.710955
## transformTransformed-Images/Splice/                0.372 0.709896
## transformTransformed-Images/Wave-Tools/           -1.582 0.113607
## baseimg2axe2.jpg                                   4.463 8.15e-06 ***
## baseimg2axe3.jpg                                   2.570 0.010190 *
## baseimg2axe4.jpg                                   4.756 1.99e-06 ***
## baseimg2axe5.jpg                                   4.218 2.48e-05 ***
## baseimg2flash1.jpg                                 5.387 7.24e-08 ***
## baseimg2flash2.jpg                                 5.605 2.11e-08 ***
## baseimg2flash3.jpg                                 5.698 1.23e-08 ***
## baseimg2flash4.jpg                                 5.619 1.94e-08 ***
## baseimg2flash5.jpg                                 5.076 3.88e-07 ***
## baseimg2hammer1.jpg                                2.923 0.003476 **
## baseimg2hammer2.jpg                                2.487 0.012887 *
## baseimg2hammer3.jpg                                5.300 1.17e-07 ***
## baseimg2hammer4.jpg                                3.058 0.002232 **
## baseimg2hammer5.jpg                                5.705 1.18e-08 ***
## baseimg2plier1.jpg                                 4.777 1.79e-06 ***
## baseimg2plier2.jpg                               -29.588  < 2e-16 ***
## baseimg2plier3.jpg                                 2.410 0.015984 *
## baseimg2plier4.jpg                                 5.114 3.18e-07 ***
## baseimg2plier5.jpg                                 5.088 3.66e-07 ***
## baseimg2saw1.jpg                                   5.426 5.83e-08 ***
## baseimg2saw2.jpg                                   4.735 2.20e-06 ***
## baseimg2saw3.jpg                                   2.420 0.015528 *
## baseimg2saw4.jpg                                   4.769 1.86e-06 ***
## baseimg2saw5.jpg                                   5.048 4.51e-07 ***
## baseimg2scissor1.jpg                               5.065 4.13e-07 ***
```

```
## baseimg2scissor2.jpg                              5.079 3.83e-07 ***
## baseimg2scissor3.jpg                              4.711 2.49e-06 ***
## baseimg2scissor4.jpg                              5.668 1.47e-08 ***
## baseimg2scissor5.jpg                             -0.508 0.611343
## baseimg2screw1.jpg                                5.699 1.22e-08 ***
## baseimg2screw2.jpg                                5.401 6.72e-08 ***
## baseimg2screw3.jpg                                5.583 2.40e-08 ***
## baseimg2screw4.jpg                                5.203 1.99e-07 ***
## baseimg2screw5.jpg                                5.486 4.17e-08 ***
## baseimg2shovel1.jpg                               5.250 1.53e-07 ***
## baseimg2shovel2.jpg                               3.493 0.000479 ***
## baseimg2shovel3.jpg                               5.192 2.11e-07 ***
## baseimg2shovel4.jpg                               5.420 6.03e-08 ***
## baseimg2shovel5.jpg                               5.604 2.13e-08 ***
## baseimg2tape1.jpg                                 5.705 1.18e-08 ***
## baseimg2tape2.jpg                                 5.571 2.57e-08 ***
## baseimg2tape3.jpg                                 5.712 1.14e-08 ***
## baseimg2tape4.jpg                                 5.683 1.35e-08 ***
## baseimg2tape5.jpg                                 5.631 1.82e-08 ***
## baseimg2wrench1.jpg                              -8.968  < 2e-16 ***
## baseimg2wrench2.jpg                               5.414 6.25e-08 ***
## baseimg2wrench3.jpg                               5.402 6.67e-08 ***
## baseimg2wrench4.jpg                               5.601 2.16e-08 ***
## baseimg2wrench5.jpg                               5.653 1.60e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.01435936)
##
##     Null deviance: 18079.00  on 18390  degrees of freedom
## Residual deviance:   262.43  on 18276  degrees of freedom
## AIC: -25731
##
## Number of Fisher Scoring iterations: 2
```

```
anova(model1,test="Chisq")
```

```
## Analysis of Deviance Table
##
## Model: gaussian, link: identity
##
## Response: corr
##
## Terms added sequentially (first to last)
##
##
##                    Df Deviance Resid. Df Resid. Dev  Pr(>Chi)
## NULL                               18390    18079.0
## as.factor(subnum) 50  17775.2      18340      303.8 < 2.2e-16 ***
## transform         15      0.9      18325      302.9 8.659e-08 ***
## baseimg2          49     40.5      18276      262.4 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
#library(glmm)
model1 <- glm(corr~0+as.factor(subnum)+transform+baseimg2,data=class.dat)
summary(model1)
```

```
##
## Call:
## glm(formula = corr ~ 0 + as.factor(subnum) + transform + baseimg2,
##     data = class.dat)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -1.01074  -0.00385   0.00543   0.01875   0.35578
##
## Coefficients:
##                                                    Estimate Std. Error
## as.factor(subnum)1001                             0.9163731  0.0115902
## as.factor(subnum)1002                             0.9450367  0.0094886
## as.factor(subnum)1003                             0.9532741  0.0095237
## as.factor(subnum)1004                             0.9505914  0.0095478
## as.factor(subnum)1005                             0.9648883  0.0095612
## as.factor(subnum)1006                             0.9619550  0.0095180
## as.factor(subnum)1007                             0.9501641  0.0095077
## as.factor(subnum)2001                             0.9555557  0.0095124
## as.factor(subnum)2002                             0.9465844  0.0095241
## as.factor(subnum)2003                             0.9513949  0.0095128
## as.factor(subnum)2004                             0.9553536  0.0095231
## as.factor(subnum)2005                             0.9561775  0.0095356
## as.factor(subnum)2006                             0.9613482  0.0093988
## as.factor(subnum)2007                             0.9678772  0.0094961
## as.factor(subnum)2008                             0.9591957  0.0094843
## as.factor(subnum)3001                             0.9639901  0.0094644
## as.factor(subnum)3002                             0.9663413  0.0095001
## as.factor(subnum)3003                             0.9574836  0.0094889
## as.factor(subnum)3004                             0.9664857  0.0094888
## as.factor(subnum)3005                             0.9481595  0.0094008
## as.factor(subnum)3006                             0.9481593  0.0093887
## as.factor(subnum)3007                             0.9556073  0.0094343
## as.factor(subnum)4001                             0.9510695  0.0095233
## as.factor(subnum)4002                             0.9458527  0.0095348
## as.factor(subnum)4003                             0.9468326  0.0095354
## as.factor(subnum)4004                             0.9433049  0.0095229
## as.factor(subnum)4006                             0.9382259  0.0095288
## as.factor(subnum)4007                             0.9537832  0.0094114
## as.factor(subnum)5001                             0.9489754  0.0094535
## as.factor(subnum)5002                             0.9287561  0.0095113
## as.factor(subnum)5003                             0.9633553  0.0095340
## as.factor(subnum)5004                             0.9686373  0.0095002
## as.factor(subnum)5005                             0.9535318  0.0094965
## as.factor(subnum)5006                             0.9698434  0.0095063
## as.factor(subnum)5007                             0.9476107  0.0094007
## as.factor(subnum)5008                             0.9453212  0.0094849
## as.factor(subnum)6001                             0.9510297  0.0094767
## as.factor(subnum)6002                             0.9514844  0.0094770
## as.factor(subnum)6003                             0.9424365  0.0095235
```

```
## as.factor(subnum)6004                        0.9567946  0.0095127
## as.factor(subnum)6005                        0.9660215  0.0093778
## as.factor(subnum)6006                        0.9604607  0.0094338
## as.factor(subnum)6007                        0.9519434  0.0094959
## as.factor(subnum)6008                        0.9643023  0.0094112
## as.factor(subnum)7001                        0.9544925  0.0095007
## as.factor(subnum)7002                        0.9386428  0.0095111
## as.factor(subnum)7003                        0.9350157  0.0095228
## as.factor(subnum)8001                        0.9576205  0.0094890
## as.factor(subnum)8002                        0.9591490  0.0095468
## as.factor(subnum)8003                        0.9570901  0.0095586
## transformTransformed-Images/BW-Tools/        -0.0195312  0.0049508
## transformTransformed-Images/Charcol-Tools/    0.0003936  0.0049505
## transformTransformed-Images/Edge-Tools/      -0.0009368  0.0049574
## transformTransformed-Images/Edge-White-Tools/ -0.0061826  0.0049511
## transformTransformed-Images/Frame-Leaves/    -0.0023745  0.0063542
## transformTransformed-Images/Frame-Nature/     0.0021274  0.0045665
## transformTransformed-Images/Implode-Tools/   -0.0173415  0.0049506
## transformTransformed-Images/Original-Tools/   0.0009093  0.0041686
## transformTransformed-Images/Rainbow-Tools/   -0.0103171  0.0063538
## transformTransformed-Images/Resize/          -0.0034802  0.0049509
## transformTransformed-Images/Rotation/         0.0033523  0.0063538
## transformTransformed-Images/Shear-Tools/     -0.0108300  0.0049566
## transformTransformed-Images/Sketch-Tools/     0.0023549  0.0063547
## transformTransformed-Images/Splice/           0.0018442  0.0049574
## transformTransformed-Images/Wave-Tools/      -0.0100531  0.0063536
## baseimg2axe2.jpg                              0.0394182  0.0088332
## baseimg2axe3.jpg                              0.0228677  0.0088994
## baseimg2axe4.jpg                              0.0425923  0.0089554
## baseimg2axe5.jpg                              0.0373863  0.0088632
## baseimg2flash1.jpg                            0.0478941  0.0088901
## baseimg2flash2.jpg                            0.0501773  0.0089522
## baseimg2flash3.jpg                            0.0499284  0.0087619
## baseimg2flash4.jpg                            0.0506614  0.0090155
## baseimg2flash5.jpg                            0.0451043  0.0088851
## baseimg2hammer1.jpg                           0.0260392  0.0089098
## baseimg2hammer2.jpg                           0.0219135  0.0088108
## baseimg2hammer3.jpg                           0.0472723  0.0089196
## baseimg2hammer4.jpg                           0.0274083  0.0089632
## baseimg2hammer5.jpg                           0.0507123  0.0088896
## baseimg2plier1.jpg                            0.0426136  0.0089198
## baseimg2plier2.jpg                           -0.2650026  0.0089564
## baseimg2plier3.jpg                            0.0216449  0.0089831
## baseimg2plier4.jpg                            0.0449109  0.0087817
## baseimg2plier5.jpg                            0.0450662  0.0088579
## baseimg2saw1.jpg                              0.0479882  0.0088440
## baseimg2saw2.jpg                              0.0423507  0.0089437
## baseimg2saw3.jpg                              0.0218054  0.0090104
## baseimg2saw4.jpg                              0.0420969  0.0088271
## baseimg2saw5.jpg                              0.0447887  0.0088731
## baseimg2scissor1.jpg                          0.0449383  0.0088728
## baseimg2scissor2.jpg                          0.0451198  0.0088832
## baseimg2scissor3.jpg                          0.0421071  0.0089386
## baseimg2scissor4.jpg                          0.0503224  0.0088787
```

```
## baseimg2scissor5.jpg                               -0.0045306  0.0089157
## baseimg2screw1.jpg                                  0.0502386  0.0088154
## baseimg2screw2.jpg                                  0.0478918  0.0088677
## baseimg2screw3.jpg                                  0.0503224  0.0090132
## baseimg2screw4.jpg                                  0.0473338  0.0090980
## baseimg2screw5.jpg                                  0.0478873  0.0087290
## baseimg2shovel1.jpg                                 0.0466814  0.0088909
## baseimg2shovel2.jpg                                 0.0311002  0.0089036
## baseimg2shovel3.jpg                                 0.0454217  0.0087490
## baseimg2shovel4.jpg                                 0.0486867  0.0089823
## baseimg2shovel5.jpg                                 0.0503028  0.0089763
## baseimg2tape1.jpg                                   0.0506155  0.0088727
## baseimg2tape2.jpg                                   0.0498661  0.0089516
## baseimg2tape3.jpg                                   0.0505513  0.0088503
## baseimg2tape4.jpg                                   0.0504864  0.0088840
## baseimg2tape5.jpg                                   0.0503033  0.0089334
## baseimg2wrench1.jpg                                -0.0802263  0.0089454
## baseimg2wrench2.jpg                                 0.0483267  0.0089266
## baseimg2wrench3.jpg                                 0.0475845  0.0088087
## baseimg2wrench4.jpg                                 0.0501429  0.0089525
## baseimg2wrench5.jpg                                 0.0501087  0.0088633
##                                                    t value Pr(>|t|)
## as.factor(subnum)1001                               79.065  < 2e-16 ***
## as.factor(subnum)1002                               99.597  < 2e-16 ***
## as.factor(subnum)1003                              100.095  < 2e-16 ***
## as.factor(subnum)1004                               99.562  < 2e-16 ***
## as.factor(subnum)1005                              100.918  < 2e-16 ***
## as.factor(subnum)1006                              101.067  < 2e-16 ***
## as.factor(subnum)1007                               99.936  < 2e-16 ***
## as.factor(subnum)2001                              100.454  < 2e-16 ***
## as.factor(subnum)2002                               99.388  < 2e-16 ***
## as.factor(subnum)2003                              100.013  < 2e-16 ***
## as.factor(subnum)2004                              100.319  < 2e-16 ***
## as.factor(subnum)2005                              100.274  < 2e-16 ***
## as.factor(subnum)2006                              102.284  < 2e-16 ***
## as.factor(subnum)2007                              101.924  < 2e-16 ***
## as.factor(subnum)2008                              101.136  < 2e-16 ***
## as.factor(subnum)3001                              101.855  < 2e-16 ***
## as.factor(subnum)3002                              101.719  < 2e-16 ***
## as.factor(subnum)3003                              100.905  < 2e-16 ***
## as.factor(subnum)3004                              101.855  < 2e-16 ***
## as.factor(subnum)3005                              100.860  < 2e-16 ***
## as.factor(subnum)3006                              100.990  < 2e-16 ***
## as.factor(subnum)3007                              101.291  < 2e-16 ***
## as.factor(subnum)4001                               99.868  < 2e-16 ***
## as.factor(subnum)4002                               99.200  < 2e-16 ***
## as.factor(subnum)4003                               99.297  < 2e-16 ***
## as.factor(subnum)4004                               99.056  < 2e-16 ***
## as.factor(subnum)4006                               98.462  < 2e-16 ***
## as.factor(subnum)4007                              101.343  < 2e-16 ***
## as.factor(subnum)5001                              100.384  < 2e-16 ***
## as.factor(subnum)5002                               97.647  < 2e-16 ***
## as.factor(subnum)5003                              101.045  < 2e-16 ***
## as.factor(subnum)5004                              101.960  < 2e-16 ***
```

```
## as.factor(subnum)5005                          100.409  < 2e-16 ***
## as.factor(subnum)5006                          102.021  < 2e-16 ***
## as.factor(subnum)5007                          100.802  < 2e-16 ***
## as.factor(subnum)5008                           99.666  < 2e-16 ***
## as.factor(subnum)6001                          100.354  < 2e-16 ***
## as.factor(subnum)6002                          100.399  < 2e-16 ***
## as.factor(subnum)6003                           98.959  < 2e-16 ***
## as.factor(subnum)6004                          100.581  < 2e-16 ***
## as.factor(subnum)6005                          103.012  < 2e-16 ***
## as.factor(subnum)6006                          101.811  < 2e-16 ***
## as.factor(subnum)6007                          100.248  < 2e-16 ***
## as.factor(subnum)6008                          102.463  < 2e-16 ***
## as.factor(subnum)7001                          100.466  < 2e-16 ***
## as.factor(subnum)7002                           98.690  < 2e-16 ***
## as.factor(subnum)7003                           98.187  < 2e-16 ***
## as.factor(subnum)8001                          100.919  < 2e-16 ***
## as.factor(subnum)8002                          100.468  < 2e-16 ***
## as.factor(subnum)8003                          100.128  < 2e-16 ***
## transformTransformed-Images/BW-Tools/           -3.945 8.01e-05 ***
## transformTransformed-Images/Charcol-Tools/       0.080 0.936623
## transformTransformed-Images/Edge-Tools/         -0.189 0.850123
## transformTransformed-Images/Edge-White-Tools/  -1.249 0.211776
## transformTransformed-Images/Frame-Leaves/       -0.374 0.708645
## transformTransformed-Images/Frame-Nature/        0.466 0.641313
## transformTransformed-Images/Implode-Tools/      -3.503 0.000461 ***
## transformTransformed-Images/Original-Tools/      0.218 0.827324
## transformTransformed-Images/Rainbow-Tools/      -1.624 0.104444
## transformTransformed-Images/Resize/             -0.703 0.482106
## transformTransformed-Images/Rotation/            0.528 0.597776
## transformTransformed-Images/Shear-Tools/        -2.185 0.028905 *
## transformTransformed-Images/Sketch-Tools/        0.371 0.710955
## transformTransformed-Images/Splice/              0.372 0.709896
## transformTransformed-Images/Wave-Tools/         -1.582 0.113607
## baseimg2axe2.jpg                                 4.463 8.15e-06 ***
## baseimg2axe3.jpg                                 2.570 0.010190 *
## baseimg2axe4.jpg                                 4.756 1.99e-06 ***
## baseimg2axe5.jpg                                 4.218 2.48e-05 ***
## baseimg2flash1.jpg                               5.387 7.24e-08 ***
## baseimg2flash2.jpg                               5.605 2.11e-08 ***
## baseimg2flash3.jpg                               5.698 1.23e-08 ***
## baseimg2flash4.jpg                               5.619 1.94e-08 ***
## baseimg2flash5.jpg                               5.076 3.88e-07 ***
## baseimg2hammer1.jpg                              2.923 0.003476 **
## baseimg2hammer2.jpg                              2.487 0.012887 *
## baseimg2hammer3.jpg                              5.300 1.17e-07 ***
## baseimg2hammer4.jpg                              3.058 0.002232 **
## baseimg2hammer5.jpg                              5.705 1.18e-08 ***
## baseimg2plier1.jpg                               4.777 1.79e-06 ***
## baseimg2plier2.jpg                             -29.588  < 2e-16 ***
## baseimg2plier3.jpg                               2.410 0.015984 *
## baseimg2plier4.jpg                               5.114 3.18e-07 ***
## baseimg2plier5.jpg                               5.088 3.66e-07 ***
## baseimg2saw1.jpg                                 5.426 5.83e-08 ***
## baseimg2saw2.jpg                                 4.735 2.20e-06 ***
```

```
## baseimg2saw3.jpg                                    2.420 0.015528 *
## baseimg2saw4.jpg                                    4.769 1.86e-06 ***
## baseimg2saw5.jpg                                    5.048 4.51e-07 ***
## baseimg2scissor1.jpg                                5.065 4.13e-07 ***
## baseimg2scissor2.jpg                                5.079 3.83e-07 ***
## baseimg2scissor3.jpg                                4.711 2.49e-06 ***
## baseimg2scissor4.jpg                                5.668 1.47e-08 ***
## baseimg2scissor5.jpg                               -0.508 0.611343
## baseimg2screw1.jpg                                  5.699 1.22e-08 ***
## baseimg2screw2.jpg                                  5.401 6.72e-08 ***
## baseimg2screw3.jpg                                  5.583 2.40e-08 ***
## baseimg2screw4.jpg                                  5.203 1.99e-07 ***
## baseimg2screw5.jpg                                  5.486 4.17e-08 ***
## baseimg2shovel1.jpg                                 5.250 1.53e-07 ***
## baseimg2shovel2.jpg                                 3.493 0.000479 ***
## baseimg2shovel3.jpg                                 5.192 2.11e-07 ***
## baseimg2shovel4.jpg                                 5.420 6.03e-08 ***
## baseimg2shovel5.jpg                                 5.604 2.13e-08 ***
## baseimg2tape1.jpg                                   5.705 1.18e-08 ***
## baseimg2tape2.jpg                                   5.571 2.57e-08 ***
## baseimg2tape3.jpg                                   5.712 1.14e-08 ***
## baseimg2tape4.jpg                                   5.683 1.35e-08 ***
## baseimg2tape5.jpg                                   5.631 1.82e-08 ***
## baseimg2wrench1.jpg                                -8.968  < 2e-16 ***
## baseimg2wrench2.jpg                                 5.414 6.25e-08 ***
## baseimg2wrench3.jpg                                 5.402 6.67e-08 ***
## baseimg2wrench4.jpg                                 5.601 2.16e-08 ***
## baseimg2wrench5.jpg                                 5.653 1.60e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.01435936)
##
##     Null deviance: 18079.00  on 18390  degrees of freedom
## Residual deviance:   262.43  on 18276  degrees of freedom
## AIC: -25731
##
## Number of Fisher Scoring iterations: 2
```

```r
anova(model1,test="Chisq")
```

```
## Analysis of Deviance Table
##
## Model: gaussian, link: identity
##
## Response: corr
##
## Terms added sequentially (first to last)
##
##
##                    Df Deviance Resid. Df Resid. Dev  Pr(>Chi)
## NULL                               18390    18079.0
## as.factor(subnum) 50  17775.2      18340      303.8 < 2.2e-16 ***
## transform         15      0.9      18325      302.9 8.659e-08 ***
## baseimg2          49     40.5      18276      262.4 < 2.2e-16 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
errorguesses <- aggregate(pred.dat[,-c(1:6,57)],list(pred.dat$imgset),mean)
errorguesses
```

```
##                                 Group.1       D1.1       D1.2      D1.3
## 1         Transformed-Images/Blur-Tools/ 0.02564103 0.00000000 0.1538462
## 2           Transformed-Images/BW-Tools/ 0.00000000 0.17073171 0.6341463
## 3      Transformed-Images/Charcol-Tools/ 0.00000000 0.00000000 0.7804878
## 4         Transformed-Images/Edge-Tools/ 0.00000000 0.00000000 0.2564103
## 5   Transformed-Images/Edge-White-Tools/ 0.00000000 0.00000000 0.6829268
## 6       Transformed-Images/Frame-Leaves/ 0.00000000 0.00000000 0.2105263
## 7       Transformed-Images/Frame-Nature/ 0.00000000 0.00000000 0.2931034
## 8      Transformed-Images/Implode-Tools/ 0.00000000 0.02439024 0.6341463
## 9     Transformed-Images/Original-Tools/ 0.00000000 0.00000000 0.3163265
## 10     Transformed-Images/Rainbow-Tools/ 0.05263158 0.05263158 0.2105263
## 11            Transformed-Images/Resize/ 0.00000000 0.00000000 0.1219512
## 12          Transformed-Images/Rotation/ 0.00000000 0.00000000 0.3157895
## 13       Transformed-Images/Shear-Tools/ 0.05128205 0.00000000 0.2820513
## 14      Transformed-Images/Sketch-Tools/ 0.05263158 0.00000000 0.2105263
## 15            Transformed-Images/Splice/ 0.05128205 0.00000000 0.1794872
## 16        Transformed-Images/Wave-Tools/ 0.00000000 0.00000000 0.1578947
##          D1.4       D1.5       D2.1       D2.2      D2.3       D2.4
## 1  0.00000000 0.02564103 0.00000000 0.15384615 0.5897436 0.00000000
## 2  0.00000000 0.14634146 0.00000000 0.02439024 0.3170732 0.00000000
## 3  0.00000000 0.00000000 0.02439024 0.09756098 0.7804878 0.04878049
## 4  0.00000000 0.00000000 0.00000000 0.10256410 0.7435897 0.02564103
## 5  0.00000000 0.00000000 0.04878049 0.17073171 0.9756098 0.07317073
## 6  0.05263158 0.00000000 0.00000000 0.42105263 0.4210526 0.10526316
## 7  0.03448276 0.00000000 0.00000000 0.10344828 0.5344828 0.01724138
## 8  0.00000000 0.04878049 0.29268293 0.48780488 0.7317073 0.24390244
## 9  0.01020408 0.00000000 0.01020408 0.10204082 0.4795918 0.01020408
## 10 0.00000000 0.15789474 0.05263158 0.36842105 0.6842105 0.00000000
## 11 0.00000000 0.04878049 0.00000000 0.04878049 0.8048780 0.00000000
## 12 0.00000000 0.00000000 0.00000000 0.10526316 0.5263158 0.00000000
## 13 0.00000000 0.00000000 0.07692308 0.05128205 0.5897436 0.00000000
## 14 0.00000000 0.00000000 0.00000000 0.26315789 0.6315789 0.00000000
## 15 0.10256410 0.28205128 0.07692308 0.15384615 0.4871795 0.02564103
## 16 0.00000000 0.00000000 0.15789474 0.63157895 0.4210526 0.15789474
##          D2.5       D3.1       D3.2       D3.3       D3.4       D3.5
## 1  0.15384615 0.05128205 0.10256410 0.02564103 0.02564103 0.00000000
## 2  0.00000000 0.02439024 0.17073171 0.00000000 0.00000000 0.00000000
## 3  0.12195122 0.04878049 0.56097561 0.00000000 0.00000000 0.00000000
## 4  0.25641026 0.00000000 0.05128205 0.05128205 0.00000000 0.00000000
## 5  0.04878049 0.00000000 0.58536585 0.00000000 0.00000000 0.00000000
## 6  0.31578947 0.42105263 0.15789474 0.00000000 0.00000000 0.10526316
## 7  0.15517241 0.06896552 0.13793103 0.00000000 0.06896552 0.00000000
## 8  0.39024390 0.00000000 0.17073171 0.02439024 0.07317073 0.00000000
## 9  0.18367347 0.03061224 0.16326531 0.00000000 0.00000000 0.01020408
## 10 0.00000000 0.00000000 0.31578947 0.05263158 0.00000000 0.00000000
## 11 0.09756098 0.31707317 0.09756098 0.04878049 0.07317073 0.00000000
## 12 0.26315789 0.10526316 0.36842105 0.10526316 0.00000000 0.00000000
## 13 0.12820513 0.02564103 0.10256410 0.02564103 0.00000000 0.00000000
## 14 0.10526316 0.00000000 0.21052632 0.05263158 0.00000000 0.00000000
```

```
## 15 0.23076923 0.10256410 0.07692308 0.02564103 0.17948718 0.00000000
## 16 0.21052632 0.26315789 0.26315789 0.00000000 0.15789474 0.00000000
##          D4.1       D4.2       D4.3       D4.4       D4.5       D5.1
## 1  0.02564103 0.00000000 0.05128205 0.46153846 0.28205128 0.23076923
## 2  0.02439024 0.46341463 0.00000000 0.09756098 0.04878049 0.04878049
## 3  0.02439024 0.00000000 0.02439024 0.29268293 0.24390244 0.75609756
## 4  0.05128205 0.00000000 0.00000000 0.23076923 0.10256410 0.66666667
## 5  0.04878049 0.17073171 0.02439024 0.14634146 0.29268293 0.34146341
## 6  0.00000000 0.00000000 0.15789474 0.26315789 0.26315789 0.42105263
## 7  0.03448276 0.06896552 0.10344828 0.43103448 0.27586207 0.34482759
## 8  0.00000000 0.02439024 0.04878049 0.34146341 0.31707317 0.39024390
## 9  0.06122449 0.02040816 0.13265306 0.27551020 0.29591837 0.38775510
## 10 0.21052632 0.15789474 0.05263158 0.10526316 0.10526316 0.05263158
## 11 0.04878049 0.14634146 0.04878049 0.65853659 0.39024390 0.56097561
## 12 0.05263158 0.00000000 0.10526316 0.15789474 0.36842105 0.36842105
## 13 0.07692308 0.00000000 0.07692308 0.20512821 0.25641026 0.28205128
## 14 0.05263158 0.31578947 0.21052632 0.10526316 0.10526316 0.00000000
## 15 0.10256410 0.10256410 0.43589744 0.48717949 0.20512821 0.12820513
## 16 0.26315789 0.05263158 0.21052632 0.10526316 0.57894737 0.36842105
##          D5.2      D5.3       D5.4       D5.5       D6.1       D6.2
## 1  0.12820513 0.7948718 0.15384615 0.12820513 0.10256410 0.05128205
## 2  0.68292683 0.6829268 0.02439024 0.51219512 0.00000000 0.00000000
## 3  0.39024390 0.9268293 0.04878049 0.60975610 0.02439024 0.19512195
## 4  0.17948718 0.7692308 0.02564103 0.15384615 0.02564103 0.05128205
## 5  0.00000000 0.9268293 0.00000000 0.65853659 0.00000000 0.00000000
## 6  0.05263158 0.3684211 0.10526316 0.00000000 0.21052632 0.00000000
## 7  0.05172414 0.7241379 0.12068966 0.03448276 0.17241379 0.05172414
## 8  0.36585366 0.8048780 0.46341463 0.24390244 0.04878049 0.07317073
## 9  0.07142857 0.7346939 0.08163265 0.12244898 0.04081633 0.03061224
## 10 0.31578947 0.7894737 0.00000000 0.57894737 0.00000000 0.00000000
## 11 0.21951220 0.8536585 0.26829268 0.07317073 0.00000000 0.02439024
## 12 0.05263158 0.6842105 0.21052632 0.15789474 0.00000000 0.10526316
## 13 0.07692308 0.7179487 0.23076923 0.05128205 0.00000000 0.00000000
## 14 0.15789474 0.7894737 0.05263158 0.78947368 0.05263158 0.05263158
## 15 0.23076923 0.6410256 0.12820513 0.05128205 0.05128205 0.05128205
## 16 0.05263158 0.7368421 0.42105263 0.21052632 0.15789474 0.10526316
##          D6.3       D6.4       D6.5       D7.1       D7.2       D7.3
## 1  0.10256410 0.00000000 0.07692308 0.02564103 0.00000000 0.00000000
## 2  0.46341463 0.00000000 0.92682927 0.75609756 0.00000000 0.00000000
## 3  0.04878049 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 4  0.10256410 0.00000000 0.00000000 0.00000000 0.00000000 0.02564103
## 5  0.00000000 0.00000000 0.00000000 0.60975610 0.04878049 0.02439024
## 6  0.21052632 0.05263158 0.10526316 0.10526316 0.00000000 0.21052632
## 7  0.08620690 0.01724138 0.10344828 0.13793103 0.03448276 0.03448276
## 8  0.09756098 0.00000000 0.02439024 0.04878049 0.09756098 0.04878049
## 9  0.17346939 0.00000000 0.01020408 0.04081633 0.02040816 0.02040816
## 10 0.05263158 0.00000000 0.21052632 0.47368421 0.10526316 0.05263158
## 11 0.02439024 0.00000000 0.07317073 0.36585366 0.02439024 0.00000000
## 12 0.15789474 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 13 0.07692308 0.00000000 0.00000000 0.02564103 0.00000000 0.05128205
## 14 0.36842105 0.00000000 0.26315789 0.15789474 0.15789474 0.00000000
## 15 0.07692308 0.10256410 0.07692308 0.15384615 0.05128205 0.05128205
## 16 0.26315789 0.10526316 0.00000000 0.05263158 0.15789474 0.00000000
##          D7.4       D7.5       D8.1       D8.2       D8.3       D8.4
```

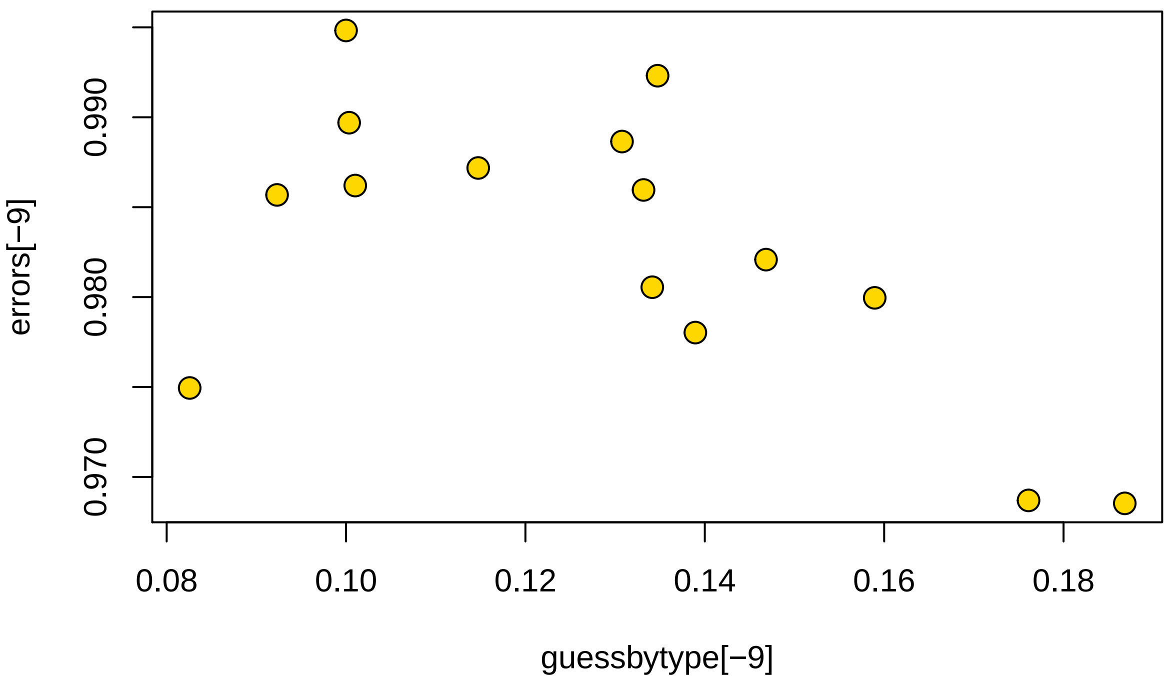
```
## 1  0.00000000 0.02564103 0.35897436 0.02564103 0.02564103 0.00000000
## 2  0.21951220 0.00000000 0.09756098 0.63414634 0.07317073 0.00000000
## 3  0.00000000 0.00000000 0.21951220 0.00000000 0.00000000 0.07317073
## 4  0.00000000 0.02564103 0.25641026 0.00000000 0.02564103 0.00000000
## 5  0.09756098 0.00000000 0.17073171 0.07317073 0.00000000 0.00000000
## 6  0.00000000 0.15789474 0.00000000 0.05263158 0.05263158 0.00000000
## 7  0.01724138 0.00000000 0.20689655 0.00000000 0.00000000 0.00000000
## 8  0.07317073 0.04878049 0.31707317 0.02439024 0.02439024 0.07317073
## 9  0.02040816 0.02040816 0.34693878 0.04081633 0.00000000 0.01020408
## 10 0.00000000 0.00000000 0.10526316 0.31578947 0.00000000 0.00000000
## 11 0.00000000 0.00000000 0.17073171 0.02439024 0.04878049 0.02439024
## 12 0.00000000 0.00000000 0.10526316 0.10526316 0.00000000 0.00000000
## 13 0.05128205 0.00000000 0.28205128 0.00000000 0.00000000 0.00000000
## 14 0.05263158 0.00000000 0.10526316 0.21052632 0.00000000 0.00000000
## 15 0.05128205 0.05128205 0.12820513 0.10256410 0.12820513 0.12820513
## 16 0.10526316 0.05263158 0.36842105 0.05263158 0.00000000 0.15789474
##          D8.5       D9.1       D9.2       D9.3       D9.4       D9.5
## 1  0.00000000 0.02564103 0.02564103 0.38461538 0.10256410 0.00000000
## 2  0.00000000 0.02439024 0.04878049 0.97560976 0.02439024 0.78048780
## 3  0.00000000 0.04878049 0.00000000 0.07317073 0.07317073 0.02439024
## 4  0.00000000 0.00000000 0.05128205 0.12820513 0.17948718 0.00000000
## 5  0.00000000 0.02439024 0.09756098 0.26829268 0.04878049 0.04878049
## 6  0.00000000 0.05263158 0.05263158 0.21052632 0.10526316 0.05263158
## 7  0.00000000 0.01724138 0.01724138 0.24137931 0.10344828 0.01724138
## 8  0.04878049 0.12195122 0.12195122 0.51219512 0.48780488 0.36585366
## 9  0.01020408 0.00000000 0.00000000 0.23469388 0.12244898 0.00000000
## 10 0.00000000 0.10526316 0.05263158 0.63157895 0.10526316 0.26315789
## 11 0.00000000 0.00000000 0.07317073 0.63414634 0.29268293 0.26829268
## 12 0.00000000 0.05263158 0.05263158 0.15789474 0.10526316 0.05263158
## 13 0.00000000 0.00000000 0.00000000 0.10256410 0.15384615 0.00000000
## 14 0.00000000 0.00000000 0.00000000 0.57894737 0.05263158 0.10526316
## 15 0.17948718 0.02564103 0.00000000 0.15384615 0.12820513 0.05128205
## 16 0.00000000 0.00000000 0.00000000 0.36842105 0.15789474 0.10526316
##         D10.1      D10.2      D10.3      D10.4      D10.5
## 1  0.00000000 0.02564103 0.00000000 0.07692308 0.05128205
## 2  0.17073171 0.02439024 0.00000000 0.00000000 0.04878049
## 3  0.00000000 0.00000000 0.09756098 0.00000000 0.00000000
## 4  0.00000000 0.02564103 0.00000000 0.02564103 0.02564103
## 5  0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 6  0.05263158 0.05263158 0.05263158 0.10526316 0.00000000
## 7  0.01724138 0.00000000 0.05172414 0.03448276 0.05172414
## 8  0.02439024 0.00000000 0.00000000 0.00000000 0.00000000
## 9  0.00000000 0.02040816 0.02040816 0.03061224 0.01020408
## 10 0.15789474 0.00000000 0.00000000 0.00000000 0.00000000
## 11 0.00000000 0.02439024 0.21951220 0.09756098 0.02439024
## 12 0.05263158 0.05263158 0.00000000 0.05263158 0.00000000
## 13 0.02564103 0.02564103 0.00000000 0.02564103 0.00000000
## 14 0.00000000 0.10526316 0.00000000 0.15789474 0.21052632
## 15 0.05128205 0.02564103 0.05128205 0.10256410 0.07692308
## 16 0.05263158 0.05263158 0.05263158 0.05263158 0.10526316
```

```
guessbytype <- (rowMeans(errorguesses[,-1]))
names(guessbytype) <- substr(errorguesses[,1],20,40)
tmp$guessbytype <- guessbytype
```

```r
errorhuman <- tapply(class.dat$corr,list(class.dat$transform,paste(class.dat$baseimg,class.dat$baseimg2
errors <- rowMeans(errorhuman)
#image(errorhuman)
```

Compute/plot correlation between guessing and actual human errors.

```r
plot(guessbytype[-9],errors[-9],col="gold",pch=16,cex=1.5)
points(guessbytype[-9],errors[-9],cex=1.5)
```




```r
cor.test(guessbytype[-9],errors[-9],method="pearson")
```

```
##
##  Pearson's product-moment correlation
##
## data:  guessbytype[-9] and errors[-9]
## t = -2.6861, df = 13, p-value = 0.01868
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.8496575 -0.1227127
## sample estimates:
##        cor
## -0.5974209
```

```r
library(BayesFactor)
correlationBF(guessbytype[-9],errors[-9])
```

```
## Bayes factor analysis
```

```
## --------------
## [1] Alt., r=0.333 : 3.990269 ±0%
##
## Against denominator:
##   Null, rho = 0
## ---
## Bayes factor type: BFcorrelation, Jeffreys-beta*
```

Look at correlations between the models and the different human judgements:

```r
models <- read.csv("../Human_data/summaries.csv")
#tmp has 16 rows, but models has 20.  This finds the right way of stretching to make them align.
modelmap <- c(1:5,7:8,10,12:14,16:20)

stretchtmp <-matrix(NA,nrow=20,ncol=5)

for(i in 1:5)
  stretchtmp[modelmap,i] <- tmp[,i+1]

colnames(stretchtmp) <- colnames(tmp[,2:6])

sumdat <- data.frame(models[,c(1:3,5:6,8:9,11:20)],
                      guessbytype=stretchtmp[,5])

 round(cor(sumdat[-12,-1],use="pairwise.complete"),3)
```

```
##                IBM.BEST IBM.ANY Google.best Google.any Amazon.best
## IBM.BEST          1.000   0.905       0.588      0.641       0.788
## IBM.ANY           0.905   1.000       0.587      0.636       0.777
## Google.best       0.588   0.587       1.000      0.981       0.895
## Google.any        0.641   0.636       0.981      1.000       0.908
## Amazon.best       0.788   0.777       0.895      0.908       1.000
## amazon.any        0.784   0.799       0.892      0.902       0.994
## Clarifai.best     0.665   0.650       0.764      0.809       0.779
## Clarifai.any      0.887   0.846       0.807      0.860       0.911
## InceptionMax      0.727   0.802       0.775      0.792       0.820
## InceptionAny      0.621   0.669       0.694      0.701       0.726
## inception2max     0.566   0.658       0.722      0.731       0.804
## inception2any     0.513   0.472       0.552      0.578       0.613
## Accuracy          0.439   0.259       0.263      0.300       0.335
## RT               -0.318  -0.012      -0.310     -0.267      -0.361
## Rating            0.300   0.273       0.212      0.154       0.342
## adjrt            -0.371  -0.066      -0.325     -0.297      -0.382
## guessbytype      -0.237   0.002      -0.386     -0.387      -0.288
##                amazon.any Clarifai.best Clarifai.any InceptionMax
## IBM.BEST            0.784         0.665        0.887        0.727
## IBM.ANY             0.799         0.650        0.846        0.802
## Google.best         0.892         0.764        0.807        0.775
## Google.any          0.902         0.809        0.860        0.792
## Amazon.best         0.994         0.779        0.911        0.820
## amazon.any          1.000         0.763        0.896        0.853
## Clarifai.best       0.763         1.000        0.870        0.579
## Clarifai.any        0.896         0.870        1.000        0.768
```

```
## InceptionMax       0.853         0.579        0.768        1.000
## InceptionAny       0.751         0.534        0.709        0.754
## inception2max      0.826         0.578        0.672        0.836
## inception2any      0.635         0.439        0.553        0.705
## Accuracy           0.373         0.270        0.360        0.477
## RT                -0.370        -0.096       -0.227       -0.399
## Rating             0.375         0.028        0.280        0.536
## adjrt             -0.399        -0.142       -0.274       -0.449
## guessbytype       -0.317        -0.104       -0.201       -0.549
##                InceptionAny inception2max inception2any Accuracy     RT
## IBM.BEST              0.621         0.566         0.513    0.439 -0.318
## IBM.ANY               0.669         0.658         0.472    0.259 -0.012
## Google.best           0.694         0.722         0.552    0.263 -0.310
## Google.any            0.701         0.731         0.578    0.300 -0.267
## Amazon.best           0.726         0.804         0.613    0.335 -0.361
## amazon.any            0.751         0.826         0.635    0.373 -0.370
## Clarifai.best         0.534         0.578         0.439    0.270 -0.096
## Clarifai.any          0.709         0.672         0.553    0.360 -0.227
## InceptionMax          0.754         0.836         0.705    0.477 -0.399
## InceptionAny          1.000         0.465         0.733    0.249 -0.306
## inception2max         0.465         1.000         0.502    0.449 -0.005
## inception2any         0.733         0.502         1.000    0.374 -0.382
## Accuracy              0.249         0.449         0.374    1.000 -0.526
## RT                   -0.306        -0.005        -0.382   -0.526  1.000
## Rating                0.149         0.512         0.181    0.427 -0.444
## adjrt                -0.319        -0.103        -0.410   -0.680  0.981
## guessbytype          -0.281        -0.328        -0.394   -0.668  0.766
##                Rating  adjrt guessbytype
## IBM.BEST        0.300 -0.371      -0.237
## IBM.ANY         0.273 -0.066       0.002
## Google.best     0.212 -0.325      -0.386
## Google.any      0.154 -0.297      -0.387
## Amazon.best     0.342 -0.382      -0.288
## amazon.any      0.375 -0.399      -0.317
## Clarifai.best   0.028 -0.142      -0.104
## Clarifai.any    0.280 -0.274      -0.201
## InceptionMax    0.536 -0.449      -0.549
## InceptionAny    0.149 -0.319      -0.281
## inception2max   0.512 -0.103      -0.328
## inception2any   0.181 -0.410      -0.394
## Accuracy        0.427 -0.680      -0.668
## RT             -0.444  0.981       0.766
## Rating          1.000 -0.477      -0.637
## adjrt          -0.477  1.000       0.813
## guessbytype    -0.637  0.813       1.000
```

```
##Compute correlation, removing the original imagery
corrs <- round(cor(sumdat[-12,-1],use="pairwise.complete"),3)[,c(13:15,17)]
corrs
```

```
##                Accuracy     RT Rating guessbytype
## IBM.BEST          0.439 -0.318  0.300      -0.237
## IBM.ANY           0.259 -0.012  0.273       0.002
## Google.best       0.263 -0.310  0.212      -0.386
## Google.any        0.300 -0.267  0.154      -0.387
```

```
## Amazon.best      0.335 -0.361  0.342      -0.288
## amazon.any       0.373 -0.370  0.375      -0.317
## Clarifai.best    0.270 -0.096  0.028      -0.104
## Clarifai.any     0.360 -0.227  0.280      -0.201
## InceptionMax     0.477 -0.399  0.536      -0.549
## InceptionAny     0.249 -0.306  0.149      -0.281
## inception2max    0.449 -0.005  0.512      -0.328
## inception2any    0.374 -0.382  0.181      -0.394
## Accuracy         1.000 -0.526  0.427      -0.668
## RT              -0.526  1.000 -0.444       0.766
## Rating           0.427 -0.444  1.000      -0.637
## adjrt           -0.680  0.981 -0.477       0.813
## guessbytype     -0.668  0.766 -0.637       1.000
```

```r
corrs2 <- round(cor(sumdat[-12,-1],use="pairwise.complete")[c(13:17),c(13:15,17)],3)
corrs2
```

```
##             Accuracy     RT Rating guessbytype
## Accuracy       1.000 -0.526  0.427      -0.668
## RT            -0.526  1.000 -0.444       0.766
## Rating         0.427 -0.444  1.000      -0.637
## adjrt         -0.680  0.981 -0.477       0.813
## guessbytype   -0.668  0.766 -0.637       1.000
```

```r
pdf("byhuman.pdf",width=6,height=6)
par(mar=c(4,10,3,2))
ylabs<-rev(c("Human Response time",
        "Human accuracy",
        "Custom inception",
        "Clarifai (any)",
        "Clarifai (best)",
        "Amazon (any)",
        "Amazon (best)",
        "Google (any)",
        "Google (best)",
         "IBM (any)",
        "IBM (best)"))


matplot(abs(corrs),1:17,type="n",pch=16,cex=2,xlab="Correlation",xlim=c(0,1.2),yaxt="n",ylab="",
        bty="n",xaxt="n",
        main="Correlation with \nHuman Ratings of difficulty")
segments(0,1:11,1,1:11,lty=3,col="grey")
text(.85, 10.5,"Human\nperformance",pos=4)
text(.85, 4.5,"AI \nPerformance",pos=4)

matplot(abs(corrs)[10:11,],10:11,type="o",pch=16,cex=2,add=T)
matplot(abs(corrs)[1:9,],1:9,type="o",pch=16,cex=2,add=T)
abline(9.5,0)
axis(1,0:5/5)
axis(2,1:11,ylabs,las=1)
legend(.6,3,c("Overall Rating","Number identified"),pch=16,lty=1:2,col=1:2,bty="n")
dev.off()
```

```
## pdf
##   2
```

Look at the slopes with each AI system for each person.

```
library(BSDA) ##for SIGN.test
```

```
## Loading required package: lattice

##
## Attaching package: 'BSDA'

## The following object is masked from 'package:datasets':
##
##     Orange
```

```
pred.bysub <- tapply(rowSums(pred.dat[,-c(1:6,57)]),list(imgset=pred.dat$imgset,subnum=pred.dat$subnum)
rating.bysub <- tapply(pred.dat[,6],  list(imgset=pred.dat$imgset,subnum=pred.dat$subnum),  mean)

acc.bysub <- tapply(class.dat$corr,list(imgset=class.dat$transform,subnum=class.dat$subnum),mean)
rt.bysub <- tapply(class.dat$rt,list(imgset=class.dat$transform,subnum=class.dat$subnum),function(x){exp


model.order <- c(1:5,7,8,10,12,13,14,16,17,18,19,20)  #rows
model.cols <-c(2,3,5,6,8,9,11:16)


##remove the 'good' imagery row. 9
corrbysub.pred <- as.data.frame(cor(pred.bysub[-9,],models[model.order,model.cols][-9,],use="pairwise.co
corrbysub.rating <- as.data.frame(cor(rating.bysub[-9,],models[model.order,model.cols][-9,],use="pairwis

##add rating-to-time
corrbysub.pred$acc <- diag(cor(pred.bysub[-9,],acc.bysub[-9,],use="pairwise.complete"))
```

```
## Warning in cor(pred.bysub[-9, ], acc.bysub[-9, ], use =
## "pairwise.complete"): the standard deviation is zero
```

```
corrbysub.pred$rt <- diag(cor(pred.bysub[-9,],rt.bysub[-9,],use="pairwise.complete"))
```

```
## Warning in cor(pred.bysub[-9, ], rt.bysub[-9, ], use =
## "pairwise.complete"): the standard deviation is zero
```

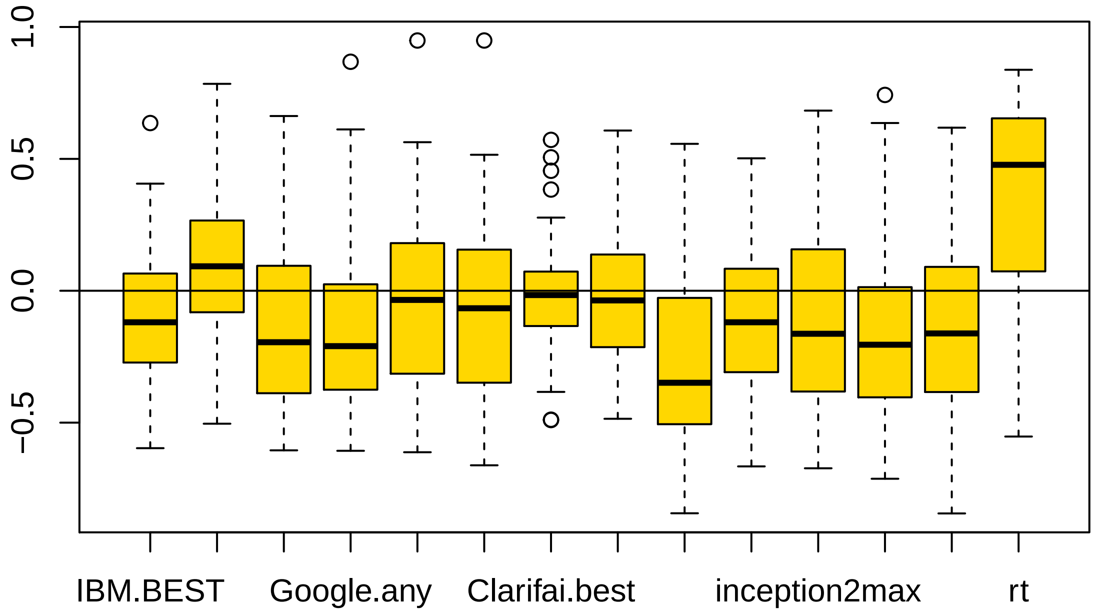
```
corrbysub.rating$acc <- diag(cor(rating.bysub[-9,],acc.bysub[-9,],use="pairwise.complete"))
```

```
## Warning in cor(rating.bysub[-9, ], acc.bysub[-9, ], use =
## "pairwise.complete"): the standard deviation is zero
```

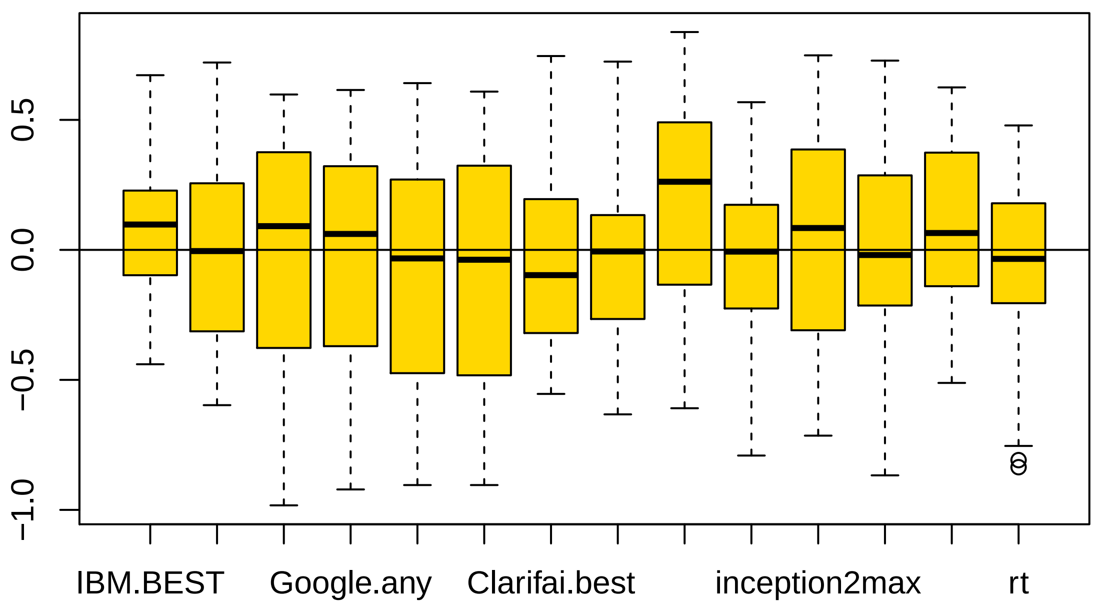
```
corrbysub.rating$rt <- diag(cor(rating.bysub[-9,],rt.bysub[-9,],use="pairwise.complete"))
```

```
## Warning in cor(rating.bysub[-9, ], rt.bysub[-9, ], use =
## "pairwise.complete"): the standard deviation is zero
```

```
boxplot(corrbysub.pred,col="gold")
abline(0,0)
```




```
boxplot(corrbysub.rating,col="gold")
abline(0,0)
```




```
##The table in tehe paper--mean correlation by subject
round(cbind(colMeans(corrbysub.rating),
            colMeans(corrbysub.pred)),3)
```

```
##                  [,1]   [,2]
## IBM.BEST        0.077 -0.090
## IBM.ANY        -0.003  0.101
## Google.best     0.010 -0.148
## Google.any     -0.010 -0.147
## Amazon.best    -0.071 -0.052
## amazon.any     -0.062 -0.075
## Clarifai.best -0.032 -0.009
## Clarifai.any   -0.007 -0.021
```

```
## InceptionMax   0.200 -0.269
## InceptionAny  -0.028 -0.107
## inception2max  0.059 -0.116
## inception2any  0.015 -0.174
## acc            0.085 -0.147
## rt            -0.059  0.355
```

This performs sign tests on the correlations with rating and pred.

```r
for(i in 1:12)
{
cat("\n\n\n\n==================================\n----------------------------\n")

  print(colnames(corrbysub.pred)[i])

    ##here, we are computnig correlation with rating. higher rating means estimate better peformance
    ##this is correlated with accuracy rate, so we are looking for a positive correlation.

  print(SIGN.test(corrbysub.rating[,i],alternative="greater"))
  print(mean(corrbysub.rating[,i]))


   ##here, we are computnig correlation with predicted number of errors. higher rating means estimate we
   ## peformance
   ##this is correlated with accuracy rate, so we are looking for a positive correlation.


  print("..............................")
  print(SIGN.test(corrbysub.pred[,i],alternative="less"))
  print( mean(corrbysub.pred[,i]))
}
```

```
##
##
##
##
## ==================================
## ----------------------------
## [1] "IBM.BEST"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 31, p-value = 0.05946
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.0002248045           Inf
## sample estimates:
## median of x
##  0.09747968
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405  0e+00    Inf
```

```
## Interpolated CI       0.9500 -2e-04    Inf
## Upper Achieved CI     0.9675 -6e-04    Inf
##
## [1] 0.07735306
## [1] "............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 15, p-value = 0.0033
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##         -Inf -0.07674997
## sample estimates:
## median of x
##  -0.1194604
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt  U.E.pt
## Lower Achieved CI     0.9405   -Inf -0.0810
## Interpolated CI       0.9500   -Inf -0.0767
## Upper Achieved CI     0.9675   -Inf -0.0689
##
## [1] -0.08994895
##
##
##
##
## ==================================
## ----------------------------
## [1] "IBM.ANY"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 25, p-value = 0.5561
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.1172711        Inf
## sample estimates:
## median of x
## -0.00465499
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.1132    Inf
## Interpolated CI       0.9500 -0.1173    Inf
## Upper Achieved CI     0.9675 -0.1249    Inf
##
## [1] -0.002988091
## [1] "............................."
##
```

```
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 33, p-value = 0.9923
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##      -Inf 0.210082
## sample estimates:
## median of x
##  0.09270094
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.2028
## Interpolated CI       0.9500   -Inf 0.2101
## Upper Achieved CI     0.9675   -Inf 0.2235
##
## [1] 0.1011108
##
##
##
##
## ==================================
## ----------------------------
## [1] "Google.best"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 29, p-value = 0.1611
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.04407659         Inf
## sample estimates:
## median of x
##  0.09125947
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.0385    Inf
## Interpolated CI       0.9500 -0.0441    Inf
## Upper Achieved CI     0.9675 -0.0543    Inf
##
## [1] 0.009524988
## [1] "............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 13, p-value = 0.0007013
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
```

```
##        -Inf -0.1345676
## sample estimates:
## median of x
##  -0.1950969
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt  U.E.pt
## Lower Achieved CI     0.9405   -Inf -0.1365
## Interpolated CI       0.9500   -Inf -0.1346
## Upper Achieved CI     0.9675   -Inf -0.1310
##
## [1] -0.1475497
##
##
##
##
## ==================================
## ----------------------------
## [1] "Google.any"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 28, p-value = 0.2399
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.08549337         Inf
## sample estimates:
## median of x
##  0.06124569
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.0778    Inf
## Interpolated CI       0.9500 -0.0855    Inf
## Upper Achieved CI     0.9675 -0.0997    Inf
##
## [1] -0.01028736
## [1] "............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 13, p-value = 0.0007013
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##        -Inf -0.1223782
## sample estimates:
## median of x
##  -0.2099527
##
## Achieved and Interpolated Confidence Intervals:
```

```
##
##                   Conf.Level L.E.pt  U.E.pt
## Lower Achieved CI     0.9405   -Inf -0.1245
## Interpolated CI       0.9500   -Inf -0.1224
## Upper Achieved CI     0.9675   -Inf -0.1185
##
## [1] -0.1469487
##
##
##
##
## ==================================
## ----------------------------
## [1] "Amazon.best"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 21, p-value = 0.8987
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.1497659        Inf
## sample estimates:
## median of x
## -0.03282661
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.1494    Inf
## Interpolated CI       0.9500 -0.1498    Inf
## Upper Achieved CI     0.9675 -0.1505    Inf
##
## [1] -0.07055692
## [1] "............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 21, p-value = 0.1611
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##        -Inf 0.04069427
## sample estimates:
## median of x
## -0.03471462
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.0374
## Interpolated CI       0.9500   -Inf 0.0407
## Upper Achieved CI     0.9675   -Inf 0.0469
##
```

```
## [1] -0.05243118
##
##
##
##
## ==================================
## ----------------------------
## [1] "amazon.any"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 23, p-value = 0.7601
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.1412813        Inf
## sample estimates:
## median of x
## -0.03792374
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.1370    Inf
## Interpolated CI       0.9500 -0.1413    Inf
## Upper Achieved CI     0.9675 -0.1492    Inf
##
## [1] -0.06243203
## [1] "............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 20, p-value = 0.1013
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##       -Inf 0.03482764
## sample estimates:
## median of x
## -0.06629033
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.0241
## Interpolated CI       0.9500   -Inf 0.0348
## Upper Achieved CI     0.9675   -Inf 0.0548
##
## [1] -0.07459055
##
##
##
##
## ==================================
```

```
## ----------------------------
## [1] "Clarifai.best"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 21, p-value = 0.8987
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.1603281        Inf
## sample estimates:
## median of x
## -0.09712646
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.1458    Inf
## Interpolated CI       0.9500 -0.1603    Inf
## Upper Achieved CI     0.9675 -0.1872    Inf
##
## [1] -0.03247358
## [1] "..............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 21, p-value = 0.1611
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##        -Inf 0.02109635
## sample estimates:
## median of x
## -0.01632264
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.0165
## Interpolated CI       0.9500   -Inf 0.0211
## Upper Achieved CI     0.9675   -Inf 0.0297
##
## [1] -0.008688442
##
##
##
##
## ==================================
## ----------------------------
## [1] "Clarifai.any"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
```

```
## s = 25, p-value = 0.5561
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.1273124        Inf
## sample estimates:
##  median of x
## -0.006039282
##
## Achieved and Interpolated Confidence Intervals:
##
##                    Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.1145    Inf
## Interpolated CI       0.9500 -0.1273    Inf
## Upper Achieved CI     0.9675 -0.1510    Inf
##
## [1] -0.007232158
## [1] "............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 24, p-value = 0.4439
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##        -Inf 0.05256418
## sample estimates:
## median of x
## -0.03660002
##
## Achieved and Interpolated Confidence Intervals:
##
##                    Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.0411
## Interpolated CI       0.9500   -Inf 0.0526
## Upper Achieved CI     0.9675   -Inf 0.0738
##
## [1] -0.02087727
##
##
##
##
## =================================
## ----------------------------
## [1] "InceptionMax"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 35, p-value = 0.0033
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  0.09876339        Inf
## sample estimates:
## median of x
```

```
##   0.2620833
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405 0.1035    Inf
## Interpolated CI       0.9500 0.0988    Inf
## Upper Achieved CI     0.9675 0.0900    Inf
##
## [1] 0.2000691
## [1] "..............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 11, p-value = 4.511e-05
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##        -Inf -0.2443319
## sample estimates:
## median of x
##   -0.348708
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt  U.E.pt
## Lower Achieved CI     0.9405   -Inf -0.2621
## Interpolated CI       0.9500   -Inf -0.2443
## Upper Achieved CI     0.9675   -Inf -0.2113
##
## [1] -0.2689204
##
##
##
##
## ==================================
## ----------------------------
## [1] "InceptionAny"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 25, p-value = 0.5561
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.1105956        Inf
## sample estimates:
##  median of x
## -0.006591742
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.1077    Inf
```

```
## Interpolated CI       0.9500 -0.1106    Inf
## Upper Achieved CI     0.9675 -0.1159    Inf
##
## [1] -0.02753181
## [1] "............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 19, p-value = 0.05946
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##         -Inf -0.01659905
## sample estimates:
## median of x
##  -0.1194495
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt  U.E.pt
## Lower Achieved CI     0.9405   -Inf -0.0312
## Interpolated CI       0.9500   -Inf -0.0166
## Upper Achieved CI     0.9675   -Inf  0.0105
##
## [1] -0.107046
##
##
##
##
## ==================================
## ----------------------------
## [1] "inception2max"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 28, p-value = 0.2399
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.03405111         Inf
## sample estimates:
## median of x
##  0.08408948
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.0249    Inf
## Interpolated CI       0.9500 -0.0341    Inf
## Upper Achieved CI     0.9675 -0.0511    Inf
##
## [1] 0.05881313
## [1] "............................."
##
```

```
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 20, p-value = 0.1013
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##        -Inf 0.01737192
## sample estimates:
## median of x
##  -0.1630131
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.0108
## Interpolated CI       0.9500   -Inf 0.0174
## Upper Achieved CI     0.9675   -Inf 0.0295
##
## [1] -0.115826
##
##
##
##
## ==================================
## ----------------------------
## [1] "inception2any"
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, i]
## s = 23, p-value = 0.7601
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.1038052        Inf
## sample estimates:
## median of x
## -0.01968001
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.1005    Inf
## Interpolated CI       0.9500 -0.1038    Inf
## Upper Achieved CI     0.9675 -0.1098    Inf
##
## [1] 0.0148715
## [1] "..............................."
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, i]
## s = 13, p-value = 0.0004681
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
```

```
##         -Inf -0.07197624
## sample estimates:
## median of x
##  -0.2045391
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt  U.E.pt
## Lower Achieved CI     0.9405   -Inf -0.0725
## Interpolated CI       0.9500   -Inf -0.0720
## Upper Achieved CI     0.9675   -Inf -0.0710
##
## [1] -0.1737875
```

This is vs. accuracy

```r
print("--------------Accuracy--------------")
```

```
## [1] "--------------Accuracy--------------"
```

```r
print(colnames(corrbysub.pred)[13])
```

```
## [1] "acc"
```

```r
print(SIGN.test(corrbysub.rating[,13],alternative="less"))
```

```
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, 13]
## s = 27, p-value = 0.8042
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##       -Inf 0.1726556
## sample estimates:
## median of x
##  0.06482268
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.1715
## Interpolated CI       0.9500   -Inf 0.1727
## Upper Achieved CI     0.9675   -Inf 0.1748
```

```r
print(SIGN.test(corrbysub.pred[,13],alternative="greater"))
```

```
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, 13]
## s = 15, p-value = 0.9972
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  -0.2852046        Inf
## sample estimates:
## median of x
```

```
## -0.1617439
##
## Achieved and Interpolated Confidence Intervals:
##
##                     Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9405 -0.2833    Inf
## Interpolated CI       0.9500 -0.2852    Inf
## Upper Achieved CI     0.9675 -0.2887    Inf
```

This is

```
print("---------------Response time-------------")
```

```
## [1] "---------------Response time-------------"
```

```
print(colnames(corrbysub.pred)[14])
```

```
## [1] "rt"
```

```
print(SIGN.test(corrbysub.rating[,14],alternative="less"))
```

```
##
##  One-sample Sign-Test
##
## data:  corrbysub.rating[, 14]
## s = 23, p-value = 0.3359
## alternative hypothesis: true median is less than 0
## 95 percent confidence interval:
##        -Inf 0.05640824
## sample estimates:
## median of x
##  -0.0346114
##
## Achieved and Interpolated Confidence Intervals:
##
##                     Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9405   -Inf 0.0469
## Interpolated CI       0.9500   -Inf 0.0564
## Upper Achieved CI     0.9675   -Inf 0.0740
```

```
print(SIGN.test(corrbysub.pred[,14],alternative="greater"))
```

```
##
##  One-sample Sign-Test
##
## data:  corrbysub.pred[, 14]
## s = 42, p-value = 5.818e-07
## alternative hypothesis: true median is greater than 0
## 95 percent confidence interval:
##  0.320221      Inf
## sample estimates:
## median of x
##   0.4774873
##
## Achieved and Interpolated Confidence Intervals:
##
##                     Conf.Level L.E.pt U.E.pt
```

```
## Lower Achieved CI     0.9405 0.3215    Inf
## Interpolated CI       0.9500 0.3202    Inf
## Upper Achieved CI     0.9675 0.3179    Inf
```