

## 2019.07.22\_Genetic-Reports-Analysis-Code.R

grecc

Wed Aug 14 10:42:26 2019

```
library(dplyr)
## Warning: package 'dplyr' was built under R version 3.5.3
##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
##
##   filter, lag
## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union

library(MASS)
## Warning: package 'MASS' was built under R version 3.5.3
##
## Attaching package: 'MASS'
## The following object is masked from 'package:dplyr':
##
##   select

library(agricolae)
## Warning: package 'agricolae' was built under R version 3.5.3

library(effsize)
## Warning: package 'effsize' was built under R version 3.5.3

library(rcompanion)
## Warning: package 'rcompanion' was built under R version 3.5.3

library(car)
## Warning: package 'car' was built under R version 3.5.3
## Loading required package: carData
##
## Attaching package: 'car'
```

```

## The following object is masked from 'package:dplyr':
##
##      recode

library(plyr)

## Warning: package 'plyr' was built under R version 3.5.3

## -----

## You have loaded plyr after dplyr - this is likely to cause problems.
## If you need functions from both plyr and dplyr, please load plyr first,
## then dplyr:
## library(plyr); library(dplyr)

## -----

##
## Attaching package: 'plyr'

## The following objects are masked from 'package:dplyr':
##
##      arrange, count, desc, failwith, id, mutate, rename, summarise,
##      summarize

library(ggplot2)

## Warning: package 'ggplot2' was built under R version 3.5.3

d <- read.delim("Results_TidyClean.tsv.txt")

alpha <- .01

# Density plots

density.by.splitvar <- function(d, varname, title, omit.nas, splitvar,
splitvar.value1, splitvar.value2, splitvar.name1, splitvar.name2,
                                splitvar.col1 = "black", splitvar.col2 =
"blue",
                                splitvar.lty1 = 3, splitvar.lty2 = 1,
splitvar.lwd1 = 2, splitvar.lwd2 = 2,
                                legend.position="topleft", sub=NULL, xlab="",
ylab="Density", xlim=NULL, ylim=NULL, bw="nrd0") {

  split1 = filter(d, d[splitvar] == splitvar.value1)
  split2 = filter(d, d[splitvar] == splitvar.value2)
  split1nrows = nrow(split1)
  split2nrows = nrow(split2)

  if (omit.nas) {
    split1 <- split1[!is.na(split1[varname]),]
    split2 <- split2[!is.na(split2[varname]),]
  }
}

```

```

}
if (nrow(split1) != split1nrows || nrow(split2) != split2nrows) {
  cat("(Removed NAs)\n")
}

plot(density(split1[[varname]], bw=bw), main = title, col=splitvar.col1,
lwd=splitvar.lwd1, lty=splitvar.lty1, sub=sub, xlab=xlab, ylab=ylab,
xlim=xlim, ylim=ylim)
lines(density(split2[[varname]], bw=bw), col=splitvar.col2,
lwd=splitvar.lwd2, lty=splitvar.lty2, sub=sub, xlab=xlab, ylab=ylab,
xlim=xlim, ylim=ylim)
legend(legend.position, legend=c(splitvar.name1, splitvar.name2),
col=c(splitvar.col1, splitvar.col2), lty=c(splitvar.lty1, splitvar.lty2),
lwd=c(splitvar.lwd1, splitvar.lwd2))
}

density.by.design <- function(d, varname, title, legend.position="topleft",
sub=NULL, xlab="", ylab="Density", xlim=NULL, ylim=NULL, bw="nrd0",
omit.nas=TRUE) {

  density.by.splitvar(d, varname, title, omit.nas, "Design", "Control",
"UCD", "Control reports", "User-centred reports",
legend.position=legend.position, sub=sub, xlab=xlab,
ylab=ylab, xlim=xlim, ylim=ylim, bw=bw, splitvar.lwd1=3)
}

density.by.testresult <- function(d, varname, title,
legend.position="topleft", sub=NULL, xlab="", ylab="Density", xlim=NULL,
ylim=NULL, bw="nrd0", omit.nas=TRUE) {

  density.by.splitvar(d, varname, title, omit.nas, "TestResult", "Positive",
"Negative", "Positive", "Negative",
"red", "black", 1, 1,
legend.position=legend.position, sub=sub, xlab=xlab,
ylab=ylab, xlim=xlim, ylim=ylim, bw=bw)
}

density.by.both <- function(d, varname, title, legend.position="topleft",
sub=NULL, xlab="", ylab="Density", xlim=NULL, ylim=NULL, bw="nrd0") {
  plot(density(filter(d, d$TestResult=="Positive" &
d$Design=="Control")[[varname]], bw=bw), main = title, col="red", lwd=2,
lty=3, sub=sub, xlab=xlab, ylab=ylab, xlim=xlim, ylim=ylim)
  lines(density(filter(d, d$TestResult=="Negative" &
d$Design=="Control")[[varname]], bw=bw), col="black", lwd=2, lty=3, sub=sub,
xlab=xlab, ylab=ylab, xlim=xlim, ylim=ylim)
  lines(density(filter(d, d$TestResult=="Positive" &
d$Design=="UCD")[[varname]], bw=bw), col="red", lwd=2, sub=sub, xlab=xlab,
ylab=ylab, xlim=xlim, ylim=ylim)
}

```

```

    lines(density(filter(d, d$TestResult=="Negative" &
d$Design=="UCD"))[[varname]], bw=bw), col="black", lwd=2, sub=sub, xlab=xlab,
ylab=ylab, xlim=xlim, ylim=ylim)
    legend(legend.position, legend=c("Positive, control", "Negative, control",
"Positive, user-centred", "Negative, user-centred"), col=c("red", "black",
"red", "black"), lwd=2, lty=c(3,3,1,1))
}

```

```

mann.whitney.by.design <- function(d, varname) {
  # Two-sample Mann-Whitney U test
  wtest = wilcox.test(d[[varname]] ~ d$Design)
  pvalue = wtest$p.value

  control <- filter(d, d$Design=="Control")[[varname]]
  ucd <- filter(d, d$Design=="UCD")[[varname]]

  control_mean <- formatC(round(mean(control, na.rm=TRUE), 2), format='f',
digits=2)
  control_sd <- formatC(round(sd(control, na.rm=TRUE), 2), format='f',
digits=2)
  ucd_mean <- formatC(round(mean(ucd, na.rm=TRUE), 2), format='f', digits=2)
  ucd_sd <- formatC(round(sd(ucd, na.rm=TRUE), 2), format='f', digits=2)

  cat(paste0("Mann-Whitney U test ",
    ifelse(pvalue < alpha, "reported", "did not report"),
    " a significant difference (alpha = ", alpha, ") between user-
centered report (M_uc=",
    ucd_mean,
    ", SD_uc=",
    ucd_sd,
    ") and standard report (M_standard=",
    control_mean,
    ", SD_standard=",
    control_sd,
    "), U=",
    formatC(round(wtest$statistic, 3), format='f', digits=3),
    ", p = ",
    formatC(round(pvalue, 3), format='f', digits=3),
    ", Cohen's d = ",
    formatC(-round(cohen.d(as.numeric(d[[varname]]),
as.factor(d$Design), pooled=TRUE, na.rm=TRUE)$estimate, 2), format='f',
digits=2)))

  cat("\n")
}

```

```

mann.whitney.by.testresult <- function(d, varname) {
  # Two-sample Mann-Whitney U test
  pvalue = wilcox.test(d[[varname]] ~ d$TestResult)$p.value

```

```

positive <- filter(d, d$TestResult=="Positive")[[varname]]
negative <- filter(d, d$TestResult=="Negative")[[varname]]

cat(paste0("Mann-Whitney U test ",
  ifelse(pvalue < .01, "reported", "did not report"),
  " a significant difference (alpha = ", alpha, ") between
positive reports (M=",
  formatC(round(mean(positive, na.rm=TRUE), 2), format='f',
digits=2),
  ", SD=",
  formatC(round(sd(positive, na.rm=TRUE), 2), format='f',
digits=2),
  ") and negative reports (M=",
  formatC(round(mean(negative, na.rm=TRUE), 2), format='f',
digits=2),
  ", SD=",
  formatC(round(sd(negative, na.rm=TRUE), 2), format='f',
digits=2),
  "), p = ",
  formatC(round(pvalue, 3), format='f', digits=3),
  ", Cohen's d = ",
  formatC(-round(cohen.d(as.numeric(d[[varname]]),
as.factor(d$TestResult), pooled=TRUE, na.rm=TRUE)$estimate, 2), format='f',
digits=2)))
  cat("\n")
}

mann.whitney.by.subjective.numeracy <- function(d, varname) {
  # Two-sample Mann-Whitney U test
  d$binary.subjective.numeracy <- as.numeric(d$subjective.numeracy > 4.34)
  pvalue = wilcox.test(d[[varname]] ~ d$binary.subjective.numeracy)$p.value

  high <- filter(d, d$binary.subjective.numeracy==1)[[varname]]
  low <- filter(d, d$binary.subjective.numeracy==0)[[varname]]

  cat(paste0("Mann-Whitney U test ",
    ifelse(pvalue < .01, "reported", "did not report"),
    " a significant difference (alpha = ", alpha, ") between high
numeracy participants (M=",
    formatC(round(mean(high, na.rm=TRUE), 2), format='f', digits=2),
    ", SD=",
    formatC(round(sd(high, na.rm=TRUE), 2), format='f', digits=2),
    ") and low numeracy participants (M=",
    formatC(round(mean(low, na.rm=TRUE), 2), format='f', digits=2),
    ", SD=",
    formatC(round(sd(low, na.rm=TRUE), 2), format='f', digits=2),
    "), p = ",
    formatC(round(pvalue, 3), format='f', digits=3),

```

```

        ", Cohen's d = ",
        formatC(round(-cohen.d(as.numeric(d[[varname]])),
as.factor(d$binary.subjective.numeracy), pooled=TRUE, na.rm=TRUE)$estimate,
2), format='f', digits=2)))
    cat("\n")
}

mann.whitney.by.education <- function(d, varname) {

    d$Education2 <- mapvalues(d$Education, from=c(2,3,4,5,7),
to=c(2,NA,NA,6,6))

    # Two-sample Mann-Whitney U test
    pvalue = wilcox.test(d[[varname]] ~ d$Education2)$p.value

    low_education = filter(d, d$Education2 == 2)[[varname]]
    high_education = filter(d, d$Education2 == 6)[[varname]]
    cat(paste0("low education count: ", length(low_education), "\n"));
    cat(paste0("high education count: ", length(high_education), "\n"));

    cat(paste0("Mann-Whitney U test ",
        ifelse(pvalue < .01, "reported", "did not report"),
        " a significant difference (alpha = ", alpha, ") between low
education participants (M=",
        formatC(round(mean(low_education, na.rm=TRUE), 2), format='f',
digits=2),
        ", SD=",
        formatC(round(sd(low_education, na.rm=TRUE), 2), format='f',
digits=2),
        ") and high education participants (M=",
        formatC(round(mean(high_education, na.rm=TRUE), 2), format='f',
digits=2),
        ", SD=",
        formatC(round(sd(high_education, na.rm=TRUE), 2), format='f',
digits=2),
        "), p = ",
        formatC(round(pvalue, 3), format='f', digits=3),
        ", Cohen's d = ",
        formatC(round(-cohen.d(as.numeric(d[[varname]])),
as.factor(d$Education2), pooled=TRUE, na.rm=TRUE)$estimate, 2), format='f',
digits=2)))
    cat("\n")
}

mann.whitney.ucd.by.testresult <- function(d, varname) {
    # Two-sample Mann-Whitney U test

```

```

pvalue = wilcox.test(d[[varname]] ~ d$TestResult)$p.value

positive <- filter(d, d$TestResult=="Positive" &
d$Design=="UCD")[[varname]]
negative <- filter(d, d$TestResult=="Negative" &
d$Design=="UCD")[[varname]]

cat(paste0("Mann-Whitney U test ",
  ifelse(pvalue < .01, "reported", "did not report"),
  " a significant difference (alpha = ", alpha, ") between UCD
positive reports (M=",
  formatC(round(mean(positive), 2), format='f', digits=2),
  ", SD=",
  formatC(round(sd(positive), 2), format='f', digits=2),
  ") and UCD negative reports (M=",
  formatC(round(mean(negative), 2), format='f', digits=2),
  ", SD=",
  formatC(round(sd(negative), 2), format='f', digits=2),
  "), p = ",
  formatC(round(pvalue, 3), format='f', digits=3),
  ", Cohen's d = ",
  formatC(-round(cohen.d(as.numeric(d[[varname]]),
as.factor(d$TestResult), pooled=TRUE)$estimate, 2), format='f', digits=2)))
cat("\n")
}

test.log.normality <- function(d, varname) {

  x <- log(d[[varname]])
  print(shapiro.test(x))
}

test.sqrt.normality <- function(d, varname) {
  x <- sqrt(d[[varname]])
  print(shapiro.test(x))
}

# Bringing it all together
analyse.by.design <- function(d, varname, title, legend.position="topleft",
sub=NULL, xlab="", ylab="Density", xlim=NULL, ylim=NULL, bw="nrd0",
omit.nas=TRUE, suppress.plot=FALSE)
{
  cat("*****\n")
  cat(title, "\n")
  cat("*****\n")
  if (!suppress.plot) {
    density.by.design(d, varname, title, legend.position=legend.position,

```

```

sub=sub, xlab=xlab, ylab=ylab, xlim=xlim, ylim=ylim, bw=bw,
omit.nas=omit.nas)
}

mann.whitney.by.design(d, varname)
cat("\n")
}

analyse.by.testresult <- function(d, varname, title,
legend.position="topleft", sub=NULL, xlab="", ylab="Density", xlim=NULL,
ylim=NULL, bw="nrd0", omit.nas=TRUE)
{
  cat("*****\n")
  cat(title, "\n")
  cat("*****\n")
  density.by.testresult(d, varname, title, legend.position=legend.position,
sub=sub, xlab=xlab, ylab=ylab, xlim=xlim, ylim=ylim, bw=bw,
omit.nas=omit.nas)
  mann.whitney.by.testresult(d, varname)
  cat("\n")
}

#####
# Key analyses of variables of interest:
# key hypothesis tests that study was powered for
#####

print("Tests for normality")

## [1] "Tests for normality"

print(shapiro.test(d$subj.understanding))

##
##  Shapiro-Wilk normality test
##
## data:  d$subj.understanding
## W = 0.90569, p-value = 9.783e-10

print(shapiro.test(d$subj.clarity))

##
##  Shapiro-Wilk normality test
##
## data:  d$subj.clarity
## W = 0.9096, p-value = 1.773e-09

print(shapiro.test(d$oc.score))

```



```
##
## Shapiro-Wilk normality test
##
## data: d$oc.score
## W = 0.81912, p-value = 3.263e-14

print(d %>% dplyr::group_by(TestResult, Design) %>%
dplyr::summarise(shapiro.test(subj.understanding)$p.value))

## # A tibble: 4 x 3
## # Groups:   TestResult [2]
##   TestResult Design `shapiro.test(subj.understanding)$p.value`
##   <fct>      <fct>      <dbl>
## 1 Negative   Control          0.00346
## 2 Negative   UCD             0.0000450
## 3 Positive   Control          0.00704
## 4 Positive   UCD             0.0000630

print(d %>% dplyr::group_by(TestResult, Design) %>%
dplyr::summarise(shapiro.test(subj.clarity)$p.value))

## # A tibble: 4 x 3
## # Groups:   TestResult [2]
##   TestResult Design `shapiro.test(subj.clarity)$p.value`
##   <fct>      <fct>      <dbl>
## 1 Negative   Control          0.00530
## 2 Negative   UCD             0.0000357
## 3 Positive   Control          0.00171
## 4 Positive   UCD             0.000101

print(d %>% dplyr::group_by(TestResult, Design) %>%
dplyr::summarise(shapiro.test(oc.score)$p.value))

## # A tibble: 4 x 3
## # Groups:   TestResult [2]
##   TestResult Design `shapiro.test(oc.score)$p.value`
##   <fct>      <fct>      <dbl>
## 1 Negative   Control          0.0000293
## 2 Negative   UCD             0.0000380
## 3 Positive   Control          0.00000662
## 4 Positive   UCD             0.00000661

print("Running U-tests as variables of interest are not normally
distributed.")

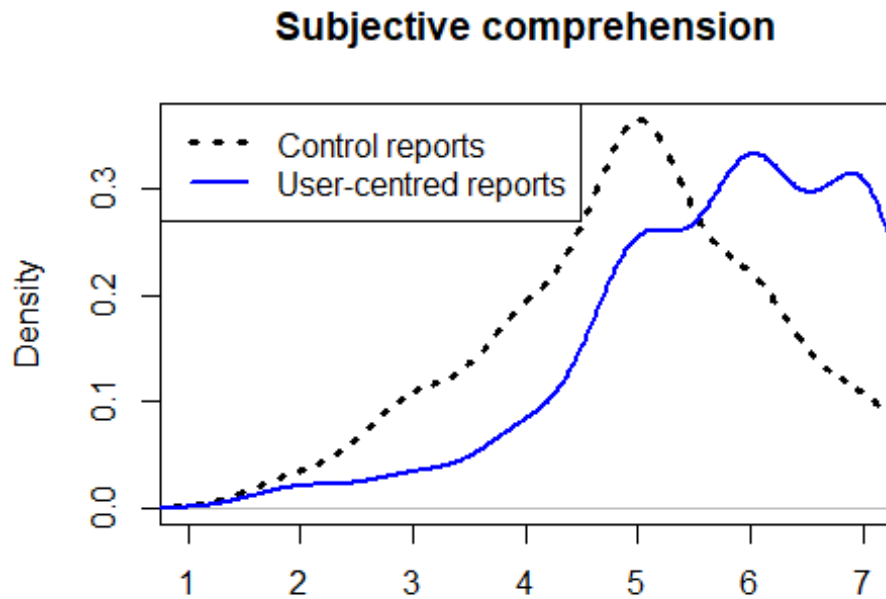
## [1] "Running U-tests as variables of interest are not normally
distributed."

print("Key hypothesis tests that study was powered for")

## [1] "Key hypothesis tests that study was powered for"
```

```
analyse.by.design(d, "subj.understanding", "Subjective comprehension",
xlim=c(1, 7))
```

```
## *****
## Subjective comprehension
## *****
```

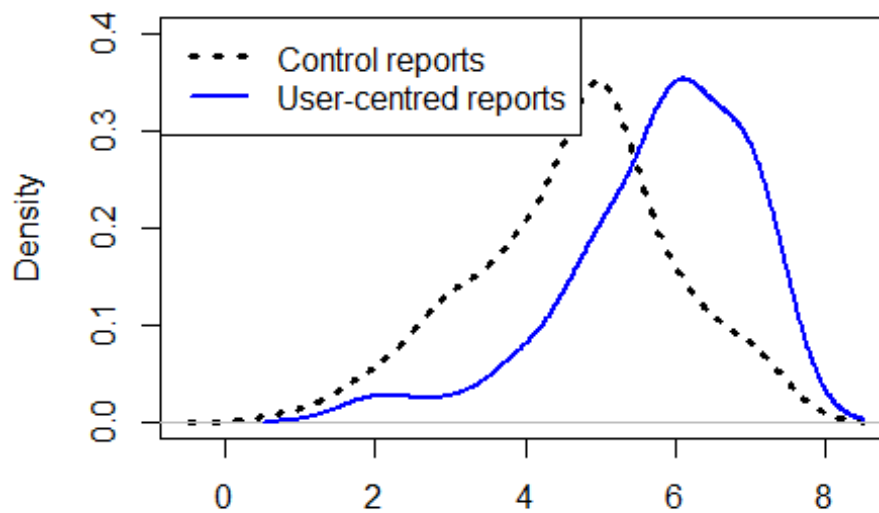


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.74, SD_uc=1.18) and standard report
(M_standard=4.94, SD_standard=1.23), U=2896.500, p = 0.000, Cohen's d = 0.67
```

```
analyse.by.design(d, "subj.clarity", "Subjective clarity", bw=.5,
ylim=c(0,.4))
```

```
## *****
## Subjective clarity
## *****
```

## Subjective clarity

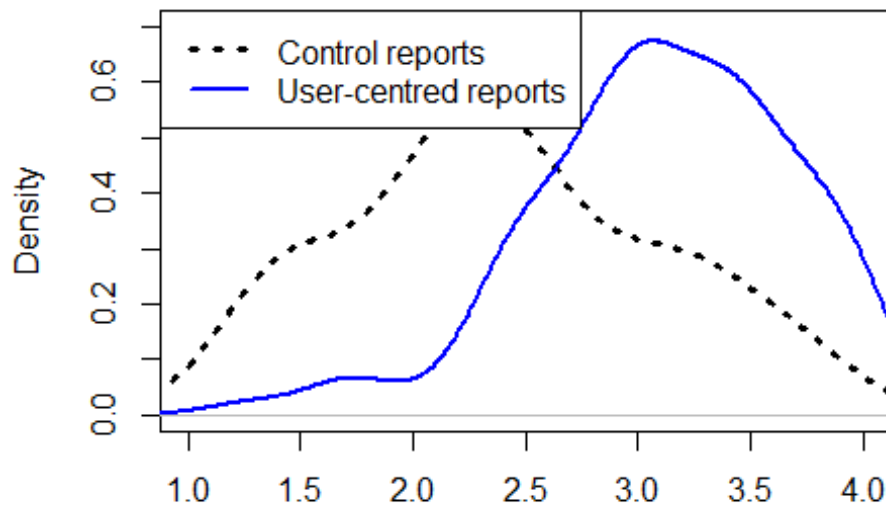


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.78, SD_uc=1.20) and standard report
(M_standard=4.65, SD_standard=1.31), U=2322.500, p = 0.000, Cohen's d = 0.90
```

```
analyse.by.design(d, "communication.efficacy", "Communication efficacy",
xlim=c(1, 4), ylim=c(0,.7))
```

```
## *****
## Communication efficacy
## *****
```

## Communication efficacy

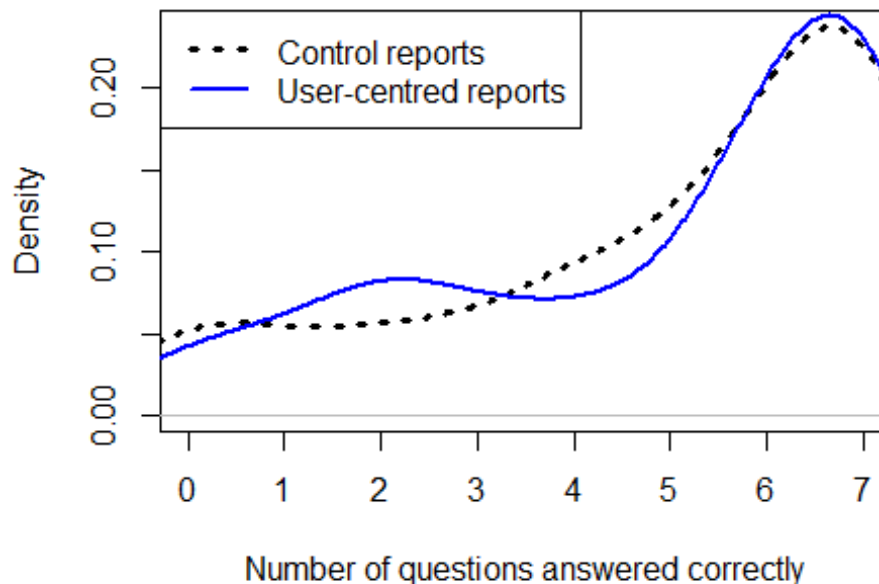


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.11, SD_uc=0.56) and standard report
(M_standard=2.41, SD_standard=0.70), U=2045.500, p = 0.000, Cohen's d = 1.10
```

```
analyse.by.design(d, "oc.score", "Risk probability comprehension", xlim=c(0,
7), xlab="Number of questions answered correctly")
```

```
## *****
## Risk probability comprehension
## *****
```

## Risk probability comprehension



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=4.95, SD_uc=2.30) and standard report
(M_standard=4.94, SD_standard=2.31), U=4618.000, p = 0.921, Cohen's d = 0.00
```

```
print("Planned 2x2 ANOVAs crossing design with test result,")
```

```
## [1] "Planned 2x2 ANOVAs crossing design with test result,"
```

```
print("and Scheirer-Ray-Hare extension of the Kruskal Wallis test, to rule
out interactions")
```

```
## [1] "and Scheirer-Ray-Hare extension of the Kruskal Wallis test, to rule
out interactions"
```

```
print(summary(aov(subj.understanding ~ TestResult * Design, data = d)))
```

```
##              Df Sum Sq Mean Sq F value    Pr(>F)
## TestResult      1   1.27    1.270     0.876    0.351
## Design          1  31.18   31.184   21.495 6.6e-06 ***
## TestResult:Design  1   2.78    2.784    1.919    0.168
## Residuals     189 274.19    1.451
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
print(summary(aov(subj.clarity ~ TestResult * Design, data = d)))
```

```
##              Df Sum Sq Mean Sq F value    Pr(>F)
## TestResult      1   0.20    0.20    0.126    0.723
```

```

## Design          1  62.49   62.49  39.388 2.32e-09 ***
## TestResult:Design 1   2.34    2.34   1.475   0.226
## Residuals       189 299.83    1.59
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(summary(aov(communication.efficacy ~ TestResult * Design, data = d)))

##              Df Sum Sq Mean Sq F value    Pr(>F)
## TestResult      1   0.05   0.046   0.114    0.736
## Design          1  23.59  23.591  58.093 1.18e-12 ***
## TestResult:Design 1   0.04   0.036   0.090    0.765
## Residuals      189   76.75   0.406
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(summary(aov(oc.score ~ TestResult * Design, data = d)))

##              Df Sum Sq Mean Sq F value    Pr(>F)
## TestResult      1    1.5   1.508   0.285 0.5938
## Design          1    0.0   0.005   0.001 0.9758
## TestResult:Design 1   14.5  14.536   2.752 0.0988 .
## Residuals      189  998.3   5.282
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(scheirerRayHare(subj.understanding ~ TestResult * Design, data = d))

##
## DV: subj.understanding
## Observations: 193
## D: 0.9403795
## MS total: 3120.167
##
##              Df Sum Sq      H p.value
## TestResult      1   2149  0.7324 0.39211
## Design          1  64045 21.8275 0.00000
## TestResult:Design 1   5096  1.7367 0.18756
## Residuals      189 492066

print(scheirerRayHare(subj.clarity ~ TestResult * Design, data = d))

##
## DV: subj.clarity
## Observations: 193
## D: 0.947553
## MS total: 3120.167
##
##              Df Sum Sq      H p.value
## TestResult      1    744  0.252 0.61585
## Design          1 112955 38.205 0.00000

```

```

## TestResult:Design    1    4235    1.432 0.23138
## Residuals           189 449719

print(scheirerRayHare(communication.efficacy ~ TestResult * Design, data =
d))

##
## DV: communication.efficacy
## Observations: 193
## D: 0.9991278
## MS total: 3120.167
##
##              Df Sum Sq      H p.value
## TestResult    1    867    0.278 0.59799
## Design        1 141359 45.345 0.00000
## TestResult:Design 1    494    0.158 0.69066
## Residuals     189 455830

print(scheirerRayHare(oc.score ~ TestResult * Design, data = d))

##
## DV: oc.score
## Observations: 193
## D: 0.9394138
## MS total: 3120.167
##
##              Df Sum Sq      H p.value
## TestResult    1   6805  2.32161 0.12759
## Design        1     25  0.00869 0.92575
## TestResult:Design 1   8593  2.93153 0.08687
## Residuals     189 547353

#####
# EXPLORATORY ANALYSES START HERE
#####
#
cat("\n\n")

cat("Exploratory analyses", fill=TRUE)

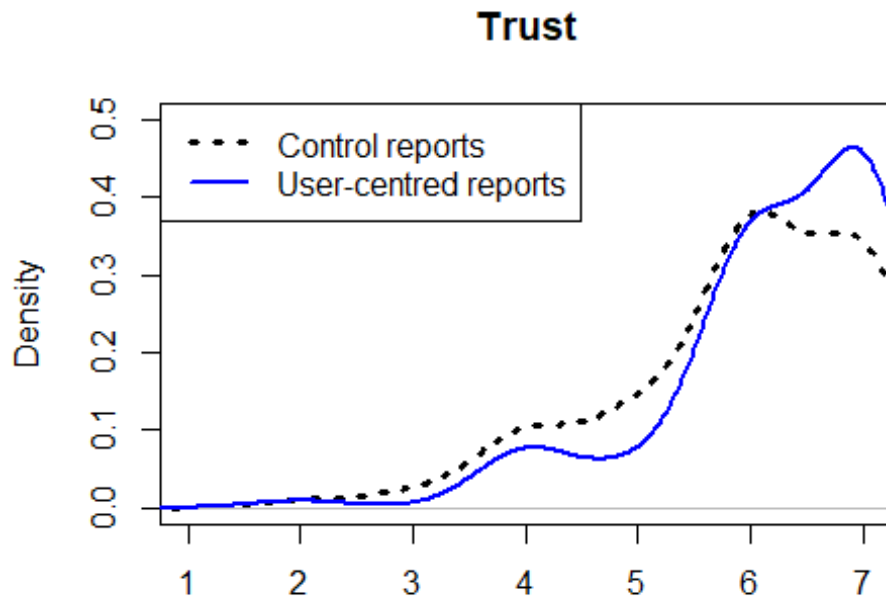
## Exploratory analyses

cat("\n\n")

analyse.by.design(d, "subj.trusted", "Trust", xlim=c(1, 7), bw=.45,
ylim=c(0,.5))

## *****
## Trust
## *****

```

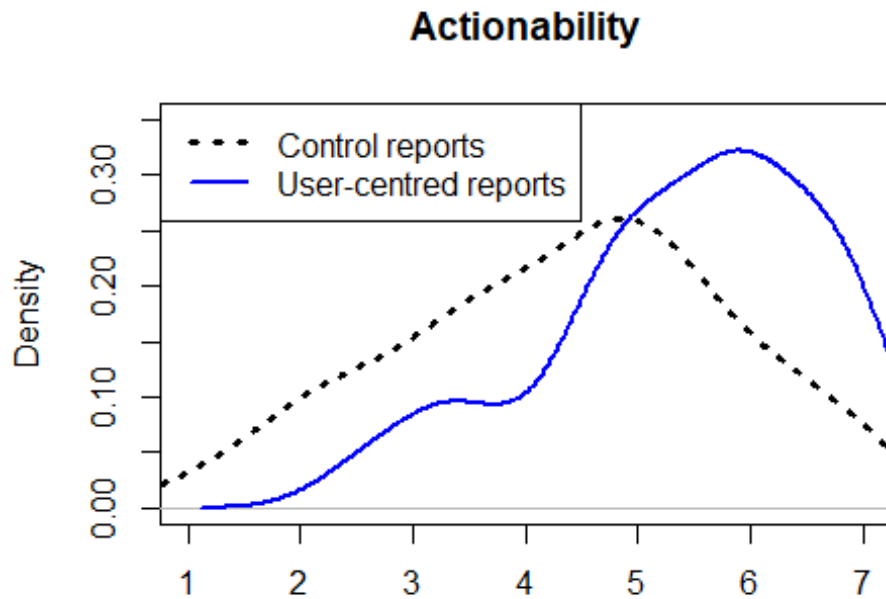


```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=6.23, SD_uc=0.99) and standard report
(M_standard=5.92, SD_standard=1.12), U=3873.500, p = 0.031, Cohen's d = 0.29
```

```
analyse.by.design(d, "Next.Steps.Average", "Actionability", xlim=c(1, 7),
ylim=c(0,.35))
```

```
## *****
## Actionability
## *****
```



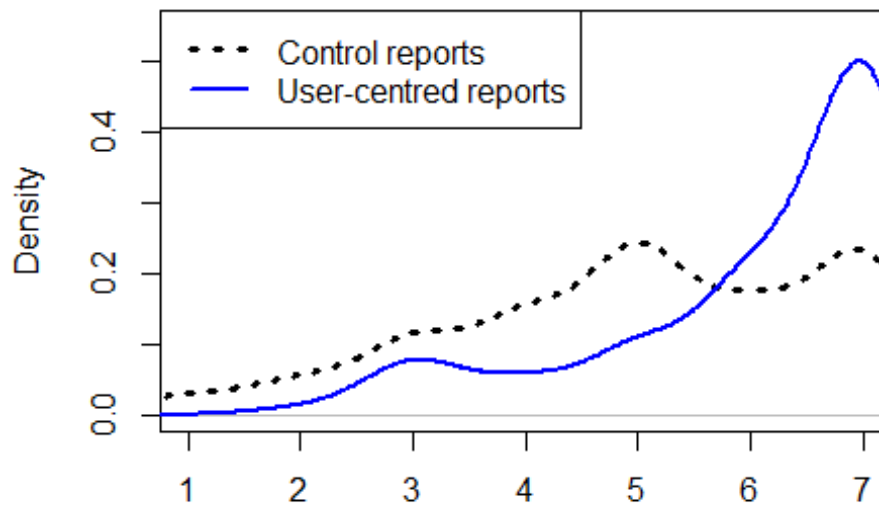


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.41, SD_uc=1.20) and standard report
(M_standard=4.37, SD_standard=1.47), U=2733.000, p = 0.000, Cohen's d = 0.77
```

```
analyse.by.design(d, "Result.Understood.Value", "How easy is it to understand
the result summary?", xlim=c(1, 7), bw=.45, ylim=c(0,.55))
```

```
## *****
## How easy is it to understand the result summary?
## *****
```

## How easy is it to understand the result summary?



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=6.05, SD_uc=1.33) and standard report
(M_standard=5.00, SD_standard=1.66), U=2876.500, p = 0.000, Cohen's d = 0.70
```

```
cat("\n\n")
```

```
cat("Correlations with subjective numeracy:", fill=TRUE)
```

```
## Correlations with subjective numeracy:
```

```
cat("Subj. understanding ", cor(d$subjective.numeracy, d$subj.understanding),
fill=TRUE)
```

```
## Subj. understanding  0.275779
```

```
cat("Subj. clarity ", cor(d$subjective.numeracy, d$subj.clarity), fill=TRUE)
```

```
## Subj. clarity  0.189341
```

```
cat("Communication efficacy ", cor(d$subjective.numeracy,
d$communication.efficacy), fill=TRUE)
```

```
## Communication efficacy  0.1413112
```

```
cat("Risk probability comprehension ", cor(d$subjective.numeracy,
d$oc.score), fill=TRUE)
```

```
## Risk probability comprehension  0.4168061
```

```

cat("Trust ", cor(d$subjective.numeracy, d$subj.trusted), fill=TRUE)

## Trust  0.2008329

cat("Actionability ", cor(d$subjective.numeracy, d$Next.Steps.Average),
fill=TRUE)

## Actionability  0.1550265

cat("Easy of understanding result summary ", cor(d$subjective.numeracy,
d$Result.Understood.Value), fill=TRUE)

## Easy of understanding result summary  0.1794436

cat("\n\n")

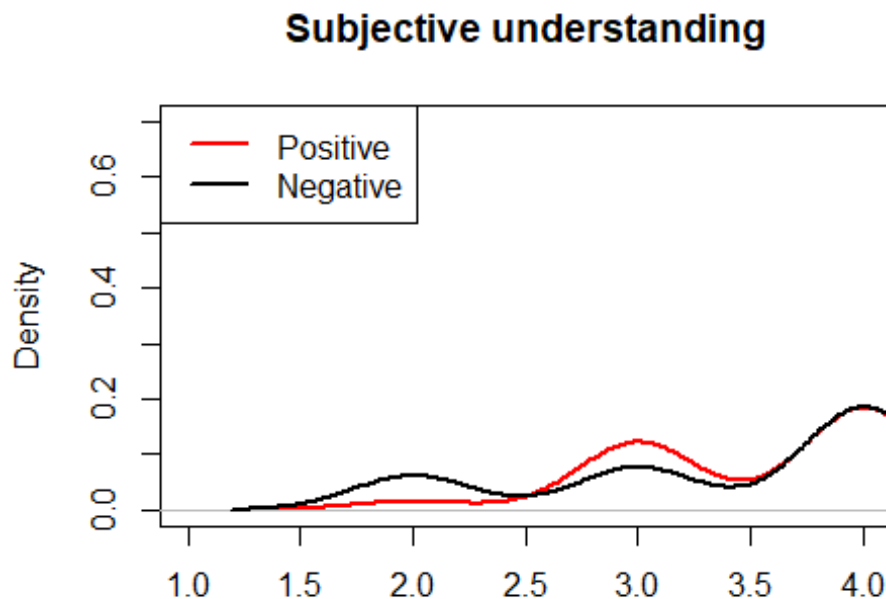
print("Analogous U-tests comparing positive vs negative reports on key
variables of interest")

## [1] "Analogous U-tests comparing positive vs negative reports on key
variables of interest"

analyse.by.testresult(d, "subj.understanding", "Subjective understanding",
xlim=c(1, 4), ylim=c(0,.7))

## *****
## Subjective understanding
## *****

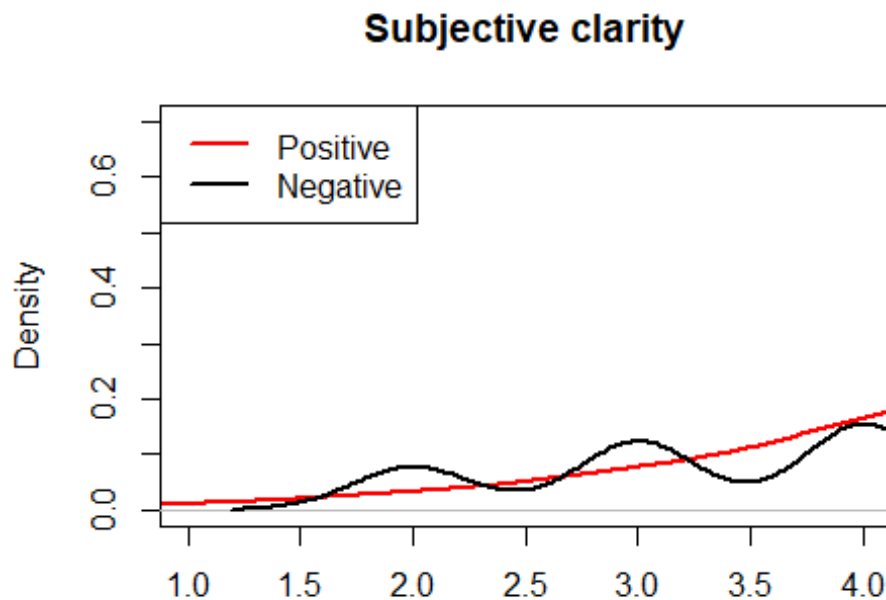
```



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between positive reports (M=5.42, SD=1.27) and negative reports (M=5.26,
SD=1.27), p = 0.393, Cohen's d = 0.13
```

```
analyse.by.testresult(d, "subj.clarity", "Subjective clarity", xlim=c(1, 4),
ylim=c(0,.7))
```

```
## *****
## Subjective clarity
## *****
```

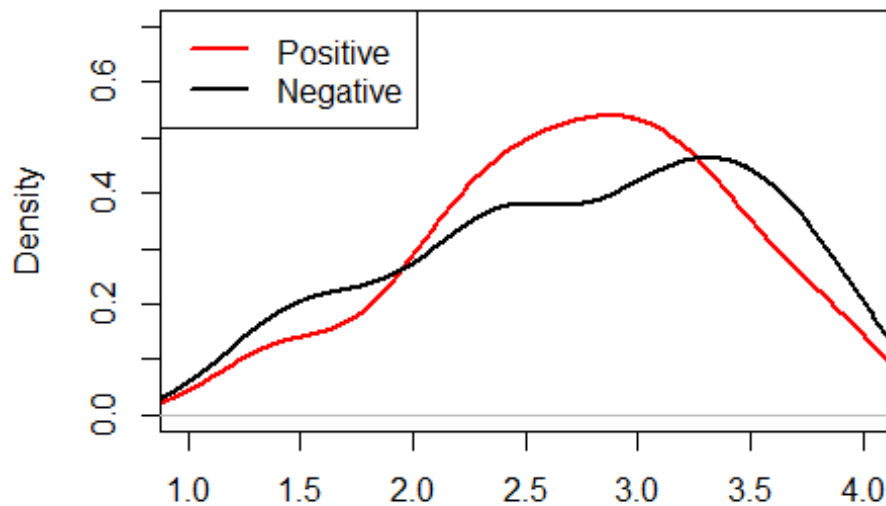


```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between positive reports (M=5.19, SD=1.38) and negative reports (M=5.25,
SD=1.38), p = 0.617, Cohen's d = -0.05
```

```
analyse.by.testresult(d, "communication.efficacy", "Communication efficacy",
xlim=c(1, 4), ylim=c(0,.7))
```

```
## *****
## Communication efficacy
## *****
```

## Communication efficacy

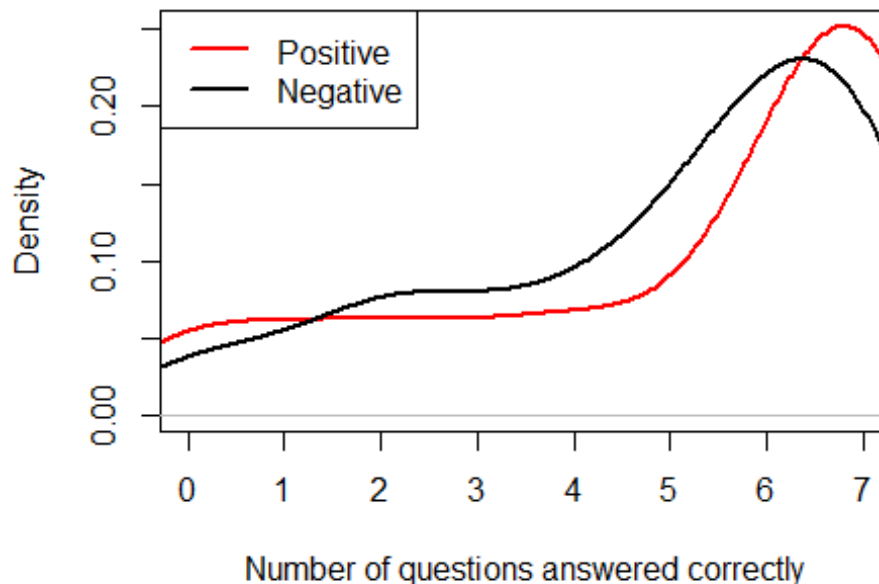


```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between positive reports (M=2.75, SD=0.68) and negative reports (M=2.78,
SD=0.77), p = 0.599, Cohen's d = -0.04
```

```
analyse.by.testresult(d, "oc.score", "Objective comprehension", xlim=c(0, 7),
xlab="Number of questions answered correctly")
```

```
## *****
## Objective comprehension
## *****
```

## Objective comprehension



## Mann-Whitney U test did not report a significant difference ( $\alpha = 0.01$ ) between positive reports ( $M=5.03$ ,  $SD=2.46$ ) and negative reports ( $M=4.85$ ,  $SD=2.13$ ),  $p = 0.128$ , Cohen's  $d = 0.08$

```
print("Item-wise analyses")
```

```
## [1] "Item-wise analyses"
```

```
d$q1 <- as.numeric(d$status.is.nearly.correct == "y")
d$q2 <- as.numeric(d$status.slider.is.nearly.correct == "y")
d$q3 <- as.numeric(d$child.is.nearly.correct == "y")
d$q4 <- as.numeric(d$child.slider.is.nearly.correct == "y")
d$q5 <- as.numeric(d$hard1000.is.nearly.correct == "y")
d$q6 <- as.numeric(d$hard800.is.nearly.correct == "y")
d$q7 <- as.numeric(d$oc.compare.is.correct == "y")
```

```
print("Item-wise chi-squared tests: comprehension questions, by design")
```

```
## [1] "Item-wise chi-squared tests: comprehension questions, by design"
```

```
print("Q1")
```

```
## [1] "Q1"
```

```
print(chisq.test(table(d$q1, d$Design)))
```

```
##
```

```
## Pearson's Chi-squared test with Yates' continuity correction
```

```

##
## data: table(d$q1, d$Design)
## X-squared = 2.3142, df = 1, p-value = 0.1282

print("Q2")

## [1] "Q2"

print(chisq.test(table(d$q2, d$Design)))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: table(d$q2, d$Design)
## X-squared = 0.98672, df = 1, p-value = 0.3205

print("Q3")

## [1] "Q3"

print(chisq.test(table(d$q3, d$Design)))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: table(d$q3, d$Design)
## X-squared = 1.2266, df = 1, p-value = 0.2681

print("Q4")

## [1] "Q4"

print(chisq.test(table(d$q4, d$Design)))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: table(d$q4, d$Design)
## X-squared = 0.31803, df = 1, p-value = 0.5728

print("Q5")

## [1] "Q5"

print(chisq.test(table(d$q5, d$Design)))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: table(d$q5, d$Design)
## X-squared = 0.96376, df = 1, p-value = 0.3262

print("Q6")

```

```

## [1] "Q6"

print(chisq.test(table(d$q6, d$Design)))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: table(d$q6, d$Design)
## X-squared = 0.22622, df = 1, p-value = 0.6343

print("Q7")

## [1] "Q7"

print(chisq.test(table(d$q7, d$Design)))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: table(d$q7, d$Design)
## X-squared = 0.62178, df = 1, p-value = 0.4304

print("Item-wise U-tests: communication efficacy questions, by design")

## [1] "Item-wise U-tests: communication efficacy questions, by design"

analyse.by.design(d, "Scheuner.1", "Scheuner 1", suppress.plot=T)

## *****
## Scheuner 1
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.31, SD_uc=0.71) and standard report
(M_standard=2.62, SD_standard=0.90), U=2670.000, p = 0.000, Cohen's d = 0.85

analyse.by.design(d, "Scheuner.2", "Scheuner 2", suppress.plot=T)

## *****
## Scheuner 2
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.38, SD_uc=0.73) and standard report
(M_standard=2.83, SD_standard=0.83), U=2934.000, p = 0.000, Cohen's d = 0.70

analyse.by.design(d, "Scheuner.3", "Scheuner 3", suppress.plot=T)

## *****
## Scheuner 3
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.29, SD_uc=0.71) and standard report
(M_standard=2.68, SD_standard=0.88), U=2851.000, p = 0.000, Cohen's d = 0.77

```



```

analyse.by.design(d, "Scheuner.4", "Scheuner 4", suppress.plot=T)

## *****
## Scheuner 4
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.35, SD_uc=0.78) and standard report
(M_standard=2.67, SD_standard=0.95), U=2761.500, p = 0.000, Cohen's d = 0.79

analyse.by.design(d, "Scheuner.5", "Scheuner 5", suppress.plot=T)

## *****
## Scheuner 5
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.10, SD_uc=0.78) and standard report
(M_standard=2.42, SD_standard=0.90), U=2749.000, p = 0.000, Cohen's d = 0.81

analyse.by.design(d, "Scheuner.6", "Scheuner 6", suppress.plot=T)

## *****
## Scheuner 6
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.25, SD_uc=0.78) and standard report
(M_standard=2.35, SD_standard=0.88), U=2227.500, p = 0.000, Cohen's d = 1.07

analyse.by.design(d, "Scheuner.7", "Scheuner 7", suppress.plot=T)

## *****
## Scheuner 7
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.34, SD_uc=0.76) and standard report
(M_standard=2.53, SD_standard=0.89), U=2380.000, p = 0.000, Cohen's d = 0.97

analyse.by.design(d, "Scheuner.8", "Scheuner 8", suppress.plot=T)

## *****
## Scheuner 8
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.13, SD_uc=0.80) and standard report
(M_standard=2.56, SD_standard=0.90), U=3021.000, p = 0.000, Cohen's d = 0.67

analyse.by.design(d, "Scheuner.9", "Scheuner 9", suppress.plot=T)

## *****
## Scheuner 9
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)

```

between user-centered report ( $M_{uc}=3.38$ ,  $SD_{uc}=0.73$ ) and standard report ( $M_{standard}=2.67$ ,  $SD_{standard}=0.88$ ),  $U=2563.500$ ,  $p = 0.000$ , Cohen's  $d = 0.89$

```
analyse.by.design(d, "Scheuner.10", "Scheuner 10", suppress.plot=T)
```

```
## *****
```

```
## Scheuner 10
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report ( $M_{uc}=3.23$ ,  $SD_{uc}=0.67$ ) and standard report
( $M_{standard}=2.47$ ,  $SD_{standard}=0.98$ ),  $U=2594.500$ ,  $p = 0.000$ , Cohen's  $d = 0.90$ 
```

```
analyse.by.design(d, "Scheuner.11", "Scheuner 11", suppress.plot=T)
```

```
## *****
```

```
## Scheuner 11
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report ( $M_{uc}=2.94$ ,  $SD_{uc}=0.79$ ) and standard report
( $M_{standard}=2.16$ ,  $SD_{standard}=1.00$ ),  $U=2639.000$ ,  $p = 0.000$ , Cohen's  $d = 0.87$ 
```

```
analyse.by.design(d, "Scheuner.12", "Scheuner 12", suppress.plot=T)
```

```
## *****
```

```
## Scheuner 12
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report ( $M_{uc}=2.95$ ,  $SD_{uc}=0.86$ ) and standard report
( $M_{standard}=1.98$ ,  $SD_{standard}=0.96$ ),  $U=2206.000$ ,  $p = 0.000$ , Cohen's  $d = 1.06$ 
```

```
analyse.by.design(d, "Scheuner.13", "Scheuner 13", suppress.plot=T)
```

```
## *****
```

```
## Scheuner 13
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report ( $M_{uc}=2.87$ ,  $SD_{uc}=0.82$ ) and standard report
( $M_{standard}=2.10$ ,  $SD_{standard}=0.92$ ),  $U=2568.500$ ,  $p = 0.000$ , Cohen's  $d = 0.87$ 
```

*# NOTE: The variables Scheuner.14 through Scheuner.18 have scores of 2 through 5 rather than 1 through 4 due to a issue with the Qualtrics mapping from choices to output numbers. The corrected values appear in the variables Scheuner.14.Value onwards, and are used below.*

```
analyse.by.design(d, "Scheuner.14.Value", "Scheuner 14", suppress.plot=T)
```

```
## *****
```

```
## Scheuner 14
```

```
## *****
```

```

## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.01, SD_uc=0.74) and standard report
(M_standard=2.46, SD_standard=0.99), U=3140.500, p = 0.000, Cohen's d = 0.63

analyse.by.design(d, "Scheuner.15.Value", "Scheuner 15", suppress.plot=T)

## *****
## Scheuner 15
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.00, SD_uc=0.88) and standard report
(M_standard=2.42, SD_standard=0.93), U=3088.000, p = 0.000, Cohen's d = 0.65

analyse.by.design(d, "Scheuner.16.Value", "Scheuner 16", suppress.plot=T)

## *****
## Scheuner 16
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=2.81, SD_uc=0.89) and standard report
(M_standard=2.27, SD_standard=0.90), U=3183.500, p = 0.000, Cohen's d = 0.61

analyse.by.design(d, "Scheuner.17.Value", "Scheuner 17", suppress.plot=T)

## *****
## Scheuner 17
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=2.97, SD_uc=0.85) and standard report
(M_standard=2.40, SD_standard=0.93), U=3106.000, p = 0.000, Cohen's d = 0.64

analyse.by.design(d, "Scheuner.18.Value", "Scheuner 18", suppress.plot=T)

## *****
## Scheuner 18
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=2.69, SD_uc=0.96) and standard report
(M_standard=1.83, SD_standard=0.83), U=2466.500, p = 0.000, Cohen's d = 0.95

print("Item-wise U-tests: actionability questions, by design")

## [1] "Item-wise U-tests: actionability questions, by design"

analyse.by.design(d, "subj.next.1", "'Next steps' question 1",
suppress.plot=T)

## *****
## 'Next steps' question 1
## *****
## Mann-Whitney U test reported a significant difference (alpha = 0.01)

```

between user-centered report ( $M_{uc}=5.53$ ,  $SD_{uc}=1.35$ ) and standard report ( $M_{standard}=4.40$ ,  $SD_{standard}=1.60$ ),  $U=2756.500$ ,  $p = 0.000$ , Cohen's  $d = 0.76$

```
analyse.by.design(d, "subj.next.2", "'Next steps' question 2",  
suppress.plot=T)
```

```
## *****
```

```
## 'Next steps' question 2
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)  
between user-centered report ( $M_{uc}=5.21$ ,  $SD_{uc}=1.52$ ) and standard report  
( $M_{standard}=4.26$ ,  $SD_{standard}=1.71$ ),  $U=3153.000$ ,  $p = 0.000$ , Cohen's  $d = 0.58$ 
```

```
analyse.by.design(d, "subj.next.3", "'Next steps' question 3",  
suppress.plot=T)
```

```
## *****
```

```
## 'Next steps' question 3
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)  
between user-centered report ( $M_{uc}=5.62$ ,  $SD_{uc}=1.32$ ) and standard report  
( $M_{standard}=4.49$ ,  $SD_{standard}=1.75$ ),  $U=2890.000$ ,  $p = 0.000$ , Cohen's  $d = 0.73$ 
```

```
analyse.by.design(d, "subj.next.4", "'Next steps' question 4",  
suppress.plot=T)
```

```
## *****
```

```
## 'Next steps' question 4
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)  
between user-centered report ( $M_{uc}=5.47$ ,  $SD_{uc}=1.30$ ) and standard report  
( $M_{standard}=4.45$ ,  $SD_{standard}=1.53$ ),  $U=2902.500$ ,  $p = 0.000$ , Cohen's  $d = 0.72$ 
```

```
analyse.by.design(d, "subj.next.5", "'Next steps' question 5",  
suppress.plot=T)
```

```
## *****
```

```
## 'Next steps' question 5
```

```
## *****
```

```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)  
between user-centered report ( $M_{uc}=5.21$ ,  $SD_{uc}=1.38$ ) and standard report  
( $M_{standard}=4.27$ ,  $SD_{standard}=1.72$ ),  $U=3259.000$ ,  $p = 0.000$ , Cohen's  $d = 0.60$ 
```

```
#####
```

```
# Differences in the degree to which people saw the box
```

```
#####
```

```
table(d$Result.Noticed.Binary, d$Design)
```

```
##
```

```
## Control UCD
```

```

##      0      8  26
##      1     88  71

control <- filter(d, d$Design=="Control")$Result.Noticed.Binary
ucd <- filter(d, d$Design=="UCD")$Result.Noticed.Binary

control_mean <- formatC(100 * round(mean(control, na.rm=TRUE), 2),
format='f', digits=0)
ucd_mean <- formatC(100 * round(mean(ucd, na.rm=TRUE), 2), format='f',
digits=0)
print(paste0("Control: ", control_mean, "% saw results summary"))

## [1] "Control: 92% saw results summary"

print(paste0("UCD: ", ucd_mean, "% saw results summary"))

## [1] "UCD: 73% saw results summary"

print(chisq.test(table(d$Result.Noticed.Binary, d$Design)))

##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  table(d$Result.Noticed.Binary, d$Design)
## X-squared = 10.105, df = 1, p-value = 0.001479

#####
# Are there differences in the probabilities of CF estimated by participants
# between the UCD & control conditions, when we restrict ourselves to the
# subset of
# reports that are positive, or the subset of reports that are negative?
#####

d$oc.child.slider.100 <- d$oc.child.slider_1 / 100.0
d$oc.status.slider.100 <- d$oc.status.slider_1 / 100.0

positives = filter(d, d$TestResult == "Positive")
negatives = filter(d, d$TestResult == "Negative")

print("Child slider results")

## [1] "Child slider results"

print(paste0("median ucd positive: ", median(filter(d, d$TestResult ==
"Positive" & d$Design == "UCD")$oc.child.slider_1, na.rm=TRUE)))

## [1] "median ucd positive: 25"

print(paste0("median control positive: ", median(filter(d, d$TestResult ==
"Positive" & d$Design == "Control")$oc.child.slider_1, na.rm=TRUE)))

```

```

## [1] "median control positive: 25"

print(paste0("median ucd negative: ", median(filter(d, d$TestResult ==
"Negative" & d$Design == "UCD")$oc.child.slider_1, na.rm=TRUE)))

## [1] "median ucd negative: 1"

print(paste0("median control negative: ", median(filter(d, d$TestResult ==
"Negative" & d$Design == "Control")$oc.child.slider_1, na.rm=TRUE)))

## [1] "median control negative: 1"

print("****")

## [1] "****"

print("Status slider results")

## [1] "Status slider results"

print(paste0("median ucd positive: ", median(filter(d, d$TestResult ==
"Positive" & d$Design == "UCD")$oc.status.slider_1, na.rm=TRUE)))

## [1] "median ucd positive: 100"

print(paste0("median control positive: ", median(filter(d, d$TestResult ==
"Positive" & d$Design == "Control")$oc.status.slider_1, na.rm=TRUE)))

## [1] "median control positive: 100"

print(paste0("median ucd negative: ", median(filter(d, d$TestResult ==
"Negative" & d$Design == "UCD")$oc.status.slider_1, na.rm=TRUE)))

## [1] "median ucd negative: 1"

print(paste0("median control negative: ", median(filter(d, d$TestResult ==
"Negative" & d$Design == "Control")$oc.status.slider_1, na.rm=TRUE)))

## [1] "median control negative: 1"

print("****")

## [1] "****"

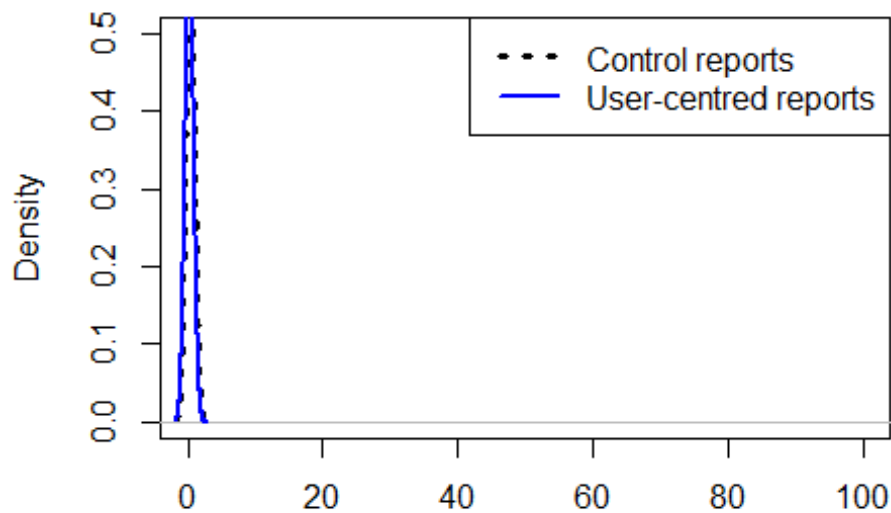
analyse.by.design(positives, "oc.child.slider.100", "Probability that child
will have CF (slider): positive reports", xlim=c(0,100), ylim=c(0,.5),
legend.position="topright", omit.nas=TRUE, bw=.6)

## *****
## Probability that child will have CF (slider): positive reports
## *****

## Warning in wilcox.test.default(x = c(0.25, 0.25, 0.51, 0.25, 0.6, 0.25, :
## cannot compute exact p-value with ties

```

## Probability that child will have CF (slider): positive re



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=0.31, SD_uc=0.16) and standard report
(M_standard=0.33, SD_standard=0.19), U=1328.500, p = 0.165, Cohen's d = -0.16
```

```
analyse.by.design(negatives, "oc.child.slider.100", "Probability that child
will have CF (slider): negative reports", xlim=c(0,100), ylim=c(0,.5),
legend.position="topright", omit.nas=TRUE, bw=.6)
```

```
## *****
```

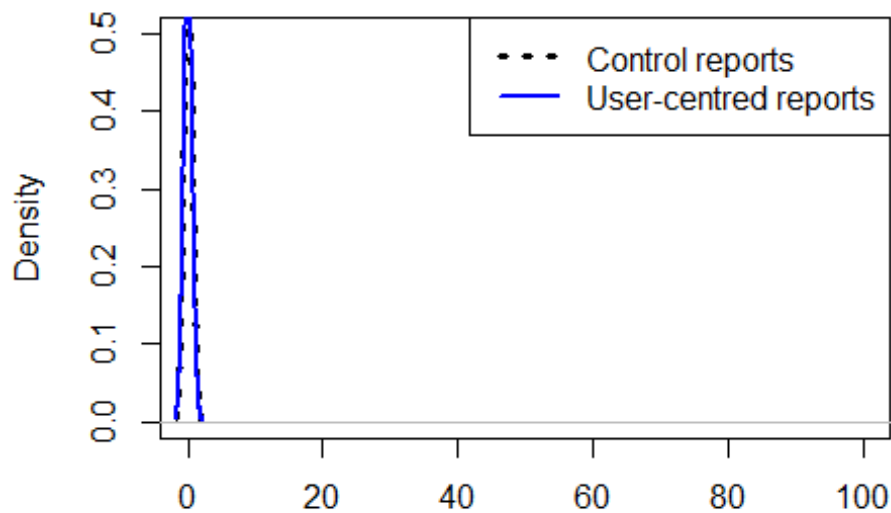
```
## Probability that child will have CF (slider): negative reports
```

```
## *****
```

```
## (Removed NAs)
```

```
## Warning in wilcox.test.default(x = c(0.01, 0, 0, 0.01, 0.01, 0.35, 0.15, :
## cannot compute exact p-value with ties
```

Probability that child will have CF (slider): negative re



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=0.10, SD_uc=0.17) and standard report
(M_standard=0.06, SD_standard=0.11), U=1099.500, p = 0.829, Cohen's d = 0.27
```

```
analyse.by.design(positives, "oc.status.slider.100", "Probability that
patient is a carrier (slider): positive reports", xlim=c(0,100),
ylim=c(0,.5), legend.position="topleft", omit.nas=TRUE, bw=.6)
```

```
## *****
```

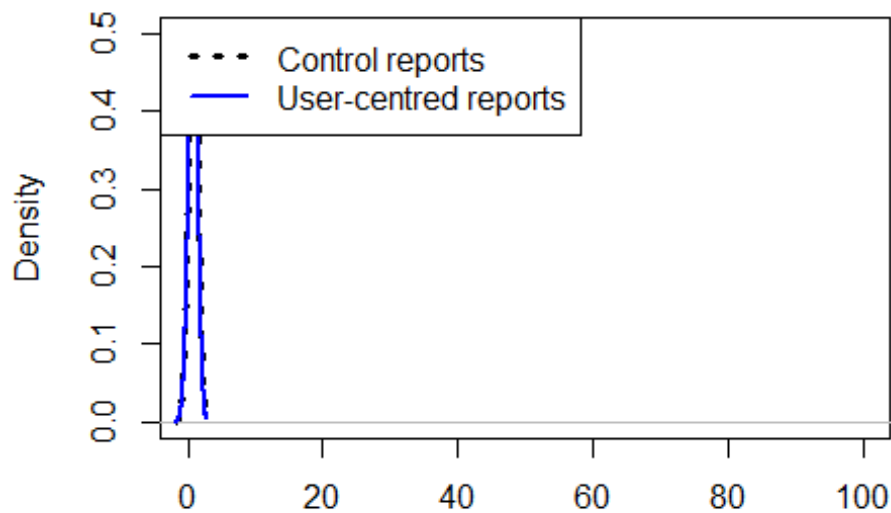
```
## Probability that patient is a carrier (slider): positive reports
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(1, 1, 0.69, 0.8, 1, 0.01, 1, 0.06, :
## cannot compute exact p-value with ties
```



Probability that patient is a carrier (slider): positive re



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=0.86, SD_uc=0.29) and standard report
(M_standard=0.80, SD_standard=0.32), U=1170.500, p = 0.968, Cohen's d = 0.19
```

```
analyse.by.design(negatives, "oc.status.slider.100", "Probability that
patient is a carrier (slider): negative reports", xlim=c(0,100),
ylim=c(0,.5), legend.position="topleft", omit.nas=TRUE, bw=.6)
```

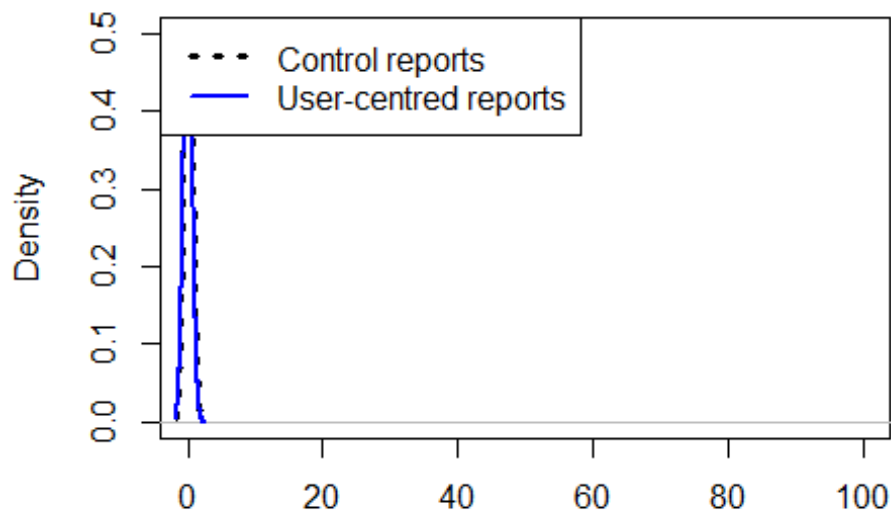
```
## *****
```

```
## Probability that patient is a carrier (slider): negative reports
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(0, 0.3, 0, 0.01, 0.02, 0.3, 0.01,
## 0.01, : cannot compute exact p-value with ties
```

## robability that patient is a carrier (slider): negative re



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=0.07, SD_uc=0.16) and standard report
(M_standard=0.07, SD_standard=0.16), U=1161.000, p = 0.947, Cohen's d = -0.02
```

```
#####
# Differences in risk probability *interpretation*
#####
```

```
print("Differences in risk probability *interpretation*")
```

```
## [1] "Differences in risk probability *interpretation*"
```

```
positives = filter(d, d$TestResult == "Positive")
fulltable = table(positives$oc.child.verbal, positives$Design)
print(fulltable)
```

```
##
##      Control UCD
##  1         1   0
##  2         8  22
##  3        36  25
##  4         0   1
##  5         3   1
```

```
print(chisq.test(fulltable))
```

```
## Warning in chisq.test(fulltable): Chi-squared approximation may be
## incorrect
```

```
##
## Pearson's Chi-squared test
##
## data: fulltable
## X-squared = 11.508, df = 4, p-value = 0.02141

print(paste0("Those who saw the user-centred positive report are more apt to
say that a child of two",
" carriers was 'unlikely' to have cystic fibrosis than those who saw the",
" standard positive report:"))

## [1] "Those who saw the user-centred positive report are more apt to say
that a child of two carriers was 'unlikely' to have cystic fibrosis than
those who saw the standard positive report:"

positives$unlikely_or_not <- as.numeric(positives$oc.child.verbal == 2) # 2
== "unlikely"
smalltable = table(positives$unlikely_or_not, positives$Design)
print(smalltable)

##
##      Control UCD
##      0      40  27
##      1       8  22

print(chisq.test(smalltable))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: smalltable
## X-squared = 7.7731, df = 1, p-value = 0.005303

print("Analyses described in Figure 1 caption")

## [1] "Analyses described in Figure 1 caption"

std_unlikely = filter(d, d$TestResult == "Positive" & d$Design == "Control" &
d$oc.child.verbal == 2)
std_likely = filter(d, d$TestResult == "Positive" & d$Design == "Control" &
d$oc.child.verbal == 3)
ucd_unlikely = filter(d, d$TestResult == "Positive" & d$Design == "UCD" &
d$oc.child.verbal == 2)
ucd_likely = filter(d, d$TestResult == "Positive" & d$Design == "UCD" &
d$oc.child.verbal == 3)

unlikely = filter(d, d$TestResult == "Positive" & d$oc.child.verbal == 2)
likely = filter(d, d$TestResult == "Positive" & d$oc.child.verbal == 3)

cat(paste0("std_unlikely ", mean(std_unlikely$oc.child.slider_1)), " (",
sd(std_unlikely$oc.child.slider_1), ")\n")
```

```

## std_unlikely 25.125 ( 0.3535534 )

cat(paste0("std_likely ", mean(std_likely$oc.child.slider_1)), " (",
sd(std_likely$oc.child.slider_1), ")\n")

## std_likely 34.44444444444444 ( 21.03663 )

cat(paste0("ucd_unlikely ", mean(ucd_unlikely$oc.child.slider_1)), " (",
sd(ucd_unlikely$oc.child.slider_1), ")\n")

## ucd_unlikely 27.4090909090909 ( 13.97842 )

cat(paste0("ucd_likely ", mean(ucd_likely$oc.child.slider_1)), " (",
sd(ucd_likely$oc.child.slider_1), ")\n")

## ucd_likely 30.72 ( 11.59928 )

wilcox.test(likely$oc.child.slider_1 ~ likely$Design)

## Warning in wilcox.test.default(x = c(25L, 25L, 51L, 60L, 25L, 25L, 70L, :
## cannot compute exact p-value with ties

##
## Wilcoxon rank sum test with continuity correction
##
## data: likely$oc.child.slider_1 by likely$Design
## W = 473, p-value = 0.6763
## alternative hypothesis: true location shift is not equal to 0

wilcox.test(unlikely$oc.child.slider_1 ~ unlikely$Design)

## Warning in wilcox.test.default(x = c(25L, 26L, 25L, 25L, 25L, 25L, 25L, :
## cannot compute exact p-value with ties

##
## Wilcoxon rank sum test with continuity correction
##
## data: unlikely$oc.child.slider_1 by unlikely$Design
## W = 100.5, p-value = 0.4206
## alternative hypothesis: true location shift is not equal to 0

d$Clearly.Wrong = (d$TestResult == "Positive" & (d$oc.child.verbal == 1 |
d$oc.child.verbal == 4)) |
(d$TestResult == "Negative" & (d$oc.child.verbal == 3 | d$oc.child.verbal
== 4))

control <- filter(d, d$Design=="Control")$Clearly.Wrong
ucd <- filter(d, d$Design=="UCD")$Clearly.Wrong

control_mean <- formatC(100 * round(mean(control, na.rm=TRUE), 2),
format='f', digits=0)
ucd_mean <- formatC(100 * round(mean(ucd, na.rm=TRUE), 2), format='f',

```

```

digits=0)
print(paste0("Control: ", control_mean, "% clearly wrong"))

## [1] "Control: 7% clearly wrong"

print(paste0("UCD: ", ucd_mean, "% clearly wrong"))

## [1] "UCD: 5% clearly wrong"

print(chisq.test(table(d$Clearly.Wrong, d$Design)))

##
## Pearson's Chi-squared test with Yates' continuity correction
##
## data: table(d$Clearly.Wrong, d$Design)
## X-squared = 0.10025, df = 1, p-value = 0.7515

#####
# Exploring possible covariates and demographic variables
#####

print(Anova(lm(oc.score ~ Gender.Value * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: oc.score
##


|                     | Sum Sq | Df  | F value | Pr(>F) |
|---------------------|--------|-----|---------|--------|
| Gender.Value        | 0.05   | 2   | 0.0047  | 0.9953 |
| Design              | 0.01   | 1   | 0.0010  | 0.9742 |
| Gender.Value:Design | 22.52  | 2   | 2.1226  | 0.1226 |
| Residuals           | 991.80 | 187 |         |        |



print(Anova(lm(subj.understanding ~ Gender.Value * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: subj.understanding
##


|                     | Sum Sq  | Df  | F value | Pr(>F)        |
|---------------------|---------|-----|---------|---------------|
| Gender.Value        | 2.601   | 2   | 0.9149  | 0.4023        |
| Design              | 31.336  | 1   | 22.0443 | 5.142e-06 *** |
| Gender.Value:Design | 9.764   | 2   | 3.4343  | 0.0343 *      |
| Residuals           | 265.817 | 187 |         |               |


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

print(Anova(lm(communication.efficacy ~ Gender.Value * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: communication.efficacy

```

```

##              Sum Sq Df F value    Pr(>F)
## Gender.Value      1.900   2   2.4035   0.09319 .
## Design            23.579   1  59.6419 6.694e-13 ***
## Gender.Value:Design  1.013   2   1.2811   0.28016
## Residuals          73.930 187
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(subj.clarity ~ Gender.Value * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: subj.clarity
##              Sum Sq Df F value    Pr(>F)
## Gender.Value      1.000   2   0.3166   0.7290
## Design            62.555   1  39.6215 2.14e-09 ***
## Gender.Value:Design  6.173   2   1.9550   0.1445
## Residuals          295.239 187
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(oc.score ~ Age * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: oc.score
##              Sum Sq Df F value Pr(>F)
## Age              3.41   1   0.6370 0.4258
## Design           0.08   1   0.0142 0.9053
## Age:Design       10.68   1   1.9978 0.1592
## Residuals       989.38 185

print(Anova(lm(subj.understanding ~ Age * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: subj.understanding
##              Sum Sq Df F value    Pr(>F)
## Age              2.818   1   1.9297   0.1665
## Design           29.851   1  20.4441 1.094e-05 ***
## Age:Design        0.050   1   0.0339   0.8541
## Residuals       270.126 185
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(communication.efficacy ~ Age * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: communication.efficacy
##              Sum Sq Df F value    Pr(>F)
## Age              0.000   1   0.0000   0.9965

```

```

## Design      24.732    1 62.5928 2.251e-13 ***
## Age:Design   0.069    1  0.1749   0.6762
## Residuals   73.099 185
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(subj.clarity ~ Age * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: subj.clarity
##              Sum Sq Df F value    Pr(>F)
## Age              1.453  1  0.9181    0.3392
## Design           61.056  1 38.5798 3.386e-09 ***
## Age:Design        2.759  1  1.7435    0.1883
## Residuals       292.779 185
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(oc.score ~ income.lower.bound * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: oc.score
##              Sum Sq Df F value Pr(>F)
## income.lower.bound    34.25  1  6.4728 0.0118 *
## Design                 0.05  1  0.0085 0.9266
## income.lower.bound:Design  0.62  1  0.1164 0.7334
## Residuals           947.17 179
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(subj.understanding ~ income.lower.bound * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: subj.understanding
##              Sum Sq Df F value    Pr(>F)
## income.lower.bound    1.741  1  1.1913    0.2765
## Design               29.603  1 20.2532 1.219e-05 ***
## income.lower.bound:Design  1.417  1  0.9697    0.3261
## Residuals          261.637 179
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(communication.efficacy ~ income.lower.bound * Design, data =
d), type=2))

## Anova Table (Type II tests)
##
## Response: communication.efficacy

```

```

##                               Sum Sq  Df F value    Pr(>F)
## income.lower.bound           0.102   1  0.2638    0.6081
## Design                      26.107   1 67.2448 4.504e-14 ***
## income.lower.bound:Design    0.241   1  0.6209    0.4318
## Residuals                    69.496 179
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(subj.clarity ~ income.lower.bound * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: subj.clarity
##                               Sum Sq  Df F value    Pr(>F)
## income.lower.bound           0.078   1  0.0496    0.82409
## Design                      62.553   1 39.6061 2.324e-09 ***
## income.lower.bound:Design    7.088   1  4.4876    0.03552 *
## Residuals                    282.709 179
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(oc.score ~ Adults.in.House.Value * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: oc.score
##                               Sum Sq  Df F value Pr(>F)
## Adults.in.House.Value         4.36   1  0.8239 0.3652
## Design                       0.00   1  0.0000 0.9965
## Adults.in.House.Value:Design  9.79   1  1.8498 0.1754
## Residuals                    1000.22 189

print(Anova(lm(subj.understanding ~ Adults.in.House.Value * Design, data =
d), type=2))

## Anova Table (Type II tests)
##
## Response: subj.understanding
##                               Sum Sq  Df F value    Pr(>F)
## Adults.in.House.Value         3.489   1  2.4249    0.1211
## Design                      30.562   1 21.2412 7.437e-06 ***
## Adults.in.House.Value:Design  2.755   1  1.9150    0.1680
## Residuals                    271.937 189
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(communication.efficacy ~ Adults.in.House.Value * Design, data
= d), type=2))

## Anova Table (Type II tests)
##

```



```
## Response: communication.efficacy
##
##      Sum Sq   Df F value    Pr(>F)
## Adults.in.House.Value      0.277     1   0.6835    0.4094
## Design                    23.395     1  57.7553 1.342e-12 ***
## Adults.in.House.Value:Design    0.008     1   0.0201    0.8875
## Residuals                   76.559    189
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(subj.clarity ~ Adults.in.House.Value * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: subj.clarity
##
##      Sum Sq   Df F value    Pr(>F)
## Adults.in.House.Value      4.820     1   3.0846   0.08066 .
## Design                    61.297     1  39.2298 2.481e-09 ***
## Adults.in.House.Value:Design    2.278     1   1.4580   0.22875
## Residuals                  295.314    189
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(oc.score ~ Children.in.House.Value * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: oc.score
##
##      Sum Sq   Df F value    Pr(>F)
## Children.in.House.Value      4.36     1   0.8239   0.3652
## Design                       0.00     1   0.0000   0.9965
## Children.in.House.Value:Design    9.79     1   1.8498   0.1754
## Residuals                  1000.22    189

print(Anova(lm(subj.understanding ~ Children.in.House.Value * Design, data =
d), type=2))

## Anova Table (Type II tests)
##
## Response: subj.understanding
##
##      Sum Sq   Df F value    Pr(>F)
## Children.in.House.Value      3.489     1   2.4249   0.1211
## Design                    30.562     1  21.2412 7.437e-06 ***
## Children.in.House.Value:Design    2.755     1   1.9150   0.1680
## Residuals                  271.937    189
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(communication.efficacy ~ Children.in.House.Value * Design,
data = d), type=2))
```

```
## Anova Table (Type II tests)
##
## Response: communication.efficacy
##
## Sum Sq Df F value Pr(>F)
## Children.in.House.Value 0.277 1 0.6835 0.4094
## Design 23.395 1 57.7553 1.342e-12 ***
## Children.in.House.Value:Design 0.008 1 0.0201 0.8875
## Residuals 76.559 189
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(subj.clarity ~ Children.in.House.Value * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: subj.clarity
##
## Sum Sq Df F value Pr(>F)
## Children.in.House.Value 4.820 1 3.0846 0.08066 .
## Design 61.297 1 39.2298 2.481e-09 ***
## Children.in.House.Value:Design 2.278 1 1.4580 0.22875
## Residuals 295.314 189
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(oc.score ~ subjective.numeracy * Design, data = d), type=2))

## Anova Table (Type II tests)
##
## Response: oc.score
##
## Sum Sq Df F value Pr(>F)
## subjective.numeracy 176.27 1 39.7518 1.989e-09 ***
## Design 0.05 1 0.0122 0.9122
## subjective.numeracy:Design 0.01 1 0.0014 0.9704
## Residuals 838.09 189
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

print(Anova(lm(subj.understanding ~ subjective.numeracy * Design, data = d),
type=2))

## Anova Table (Type II tests)
##
## Response: subj.understanding
##
## Sum Sq Df F value Pr(>F)
## subjective.numeracy 24.180 1 18.0173 3.428e-05 ***
## Design 31.895 1 23.7660 2.299e-06 ***
## subjective.numeracy:Design 0.358 1 0.2664 0.6063
## Residuals 253.644 189
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
print(Anova(lm(communication.efficacy ~ subjective.numeracy * Design, data = d), type=2))
```

```
## Anova Table (Type II tests)
```

```
##
```

```
## Response: communication.efficacy
```

```
##               Sum Sq   Df F value    Pr(>F)
## subjective.numeracy    2.171     1   5.4957    0.0201 *
## Design                23.745     1  60.1122 5.386e-13 ***
## subjective.numeracy:Design  0.016     1   0.0405    0.8407
## Residuals              74.657    189
```

```
## ---
```

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

```
print(Anova(lm(subj.clarity ~ subjective.numeracy * Design, data = d), type=2))
```

```
## Anova Table (Type II tests)
```

```
##
```

```
## Response: subj.clarity
```

```
##               Sum Sq   Df F value    Pr(>F)
## subjective.numeracy   13.764     1   9.0193  0.003033 **
## Design                63.132     1  41.3695 1.006e-09 ***
## subjective.numeracy:Design  0.225     1   0.1474  0.701485
## Residuals            288.423    189
```

```
## ---
```

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

```
# Examine range of educational backgrounds
```

```
# 2 = GCSE or equivalent
```

```
# 3 = A-level or equivalent
```

```
# 4 = Bachelors
```

```
# 5 = Masters
```

```
# 7 = PhD or greater
```

```
#
```

```
table(d$Education)
```

```
##
```

```
##  2  3  4  5  7
```

```
## 22 61 81 21  5
```

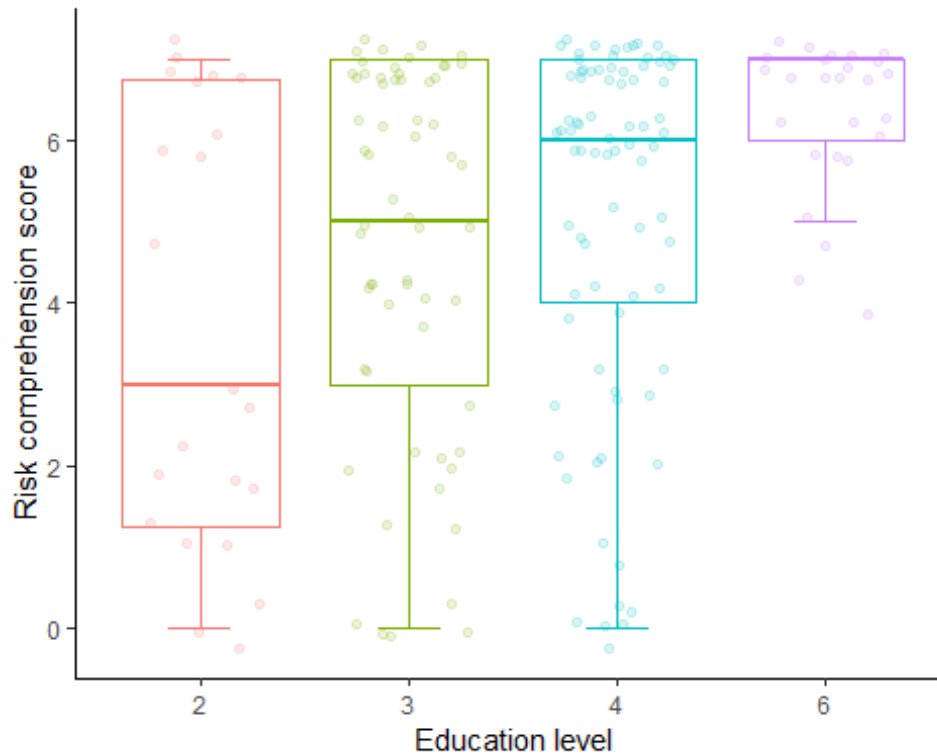
```
# Since so few in PhD category, Lump 5 & 7 together into
```

```
# 6 = Postgraduate study
```

```
d$Education2 <- as.factor(mapvalues(d$Education,
                                     from=c(2,3,4,5,7),
                                     to=c(2,3,4,6,6)))
```

```
ggplot(data=subset(d, !is.na(d$Education2)), mapping=aes(x=Education2,
y=oc.score)) + stat_boxplot(aes(col=Education2), geom = "errorbar", width = 0.3) +
```

```
geom_boxplot( aes(col=Education2),outlier.shape=NA,notch=F) + #avoid
plotting outliers twice, notch set to F as data means goes out of hinges
geom_jitter(aes(col=Education2),position = position_jitter(width = .3,
height=0.3), alpha = 0.15)+ theme_classic()+
labs(x="Education level",y="Risk comprehension score") +
theme(legend.position="none")
```



```
d$Education_low_vs_high <- mapvalues(d$Education,
from=c(2,3,4,5,7),
to=c(2,NA,NA,6,6))
```

```
print(summary(aov(oc.score ~ Education_low_vs_high * Design, data = d,
na.action=na.omit)))
```

```
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Education_low_vs_high      1  81.73    81.73  20.371 4.72e-05 ***
## Design                    1   2.45     2.45   0.610  0.439
## Education_low_vs_high:Design 1   1.26     1.26   0.315  0.577
## Residuals                44 176.54     4.01
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 145 observations deleted due to missingness
```

```
print(summary(aov(subj.understanding ~ Education_low_vs_high * Design, data =
d, na.action=na.omit)))
```

```
##                                Df Sum Sq Mean Sq F value Pr(>F)
## Education_low_vs_high          1  12.42   12.422    8.546 0.00545 **
## Design                         1    4.79    4.795    3.298 0.07616 .
## Education_low_vs_high:Design   1    0.49    0.493    0.339 0.56326
## Residuals                      44  63.96    1.454
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 145 observations deleted due to missingness

print(summary(aov(communication.efficacy ~ Education_low_vs_high * Design,
data = d, na.action=na.omit)))

##                                Df Sum Sq Mean Sq F value Pr(>F)
## Education_low_vs_high          1   0.724    0.724    1.733 0.195
## Design                         1   5.193    5.193   12.427 0.001 **
## Education_low_vs_high:Design   1   0.118    0.118    0.282 0.598
## Residuals                      44 18.386    0.418
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 145 observations deleted due to missingness

print(summary(aov(subj.clarity ~ Education_low_vs_high * Design, data = d,
na.action=na.omit)))

##                                Df Sum Sq Mean Sq F value Pr(>F)
## Education_low_vs_high          1    3.92    3.918    2.403 0.1283
## Design                         1    7.93    7.927    4.861 0.0327 *
## Education_low_vs_high:Design   1    0.06    0.064    0.039 0.8442
## Residuals                      44  71.76    1.631
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 145 observations deleted due to missingness

#####
# New analyses - following up on reviewer questions
#####

d$University <- mapvalues(d$Education,
                          from=c(2,3,4,5,7),
                          to=c(0,0,1,1,1))
no_uni = filter(d, d$University == 0)

print(summary(aov(oc.score ~ TestResult * Design, data = no_uni,
na.action=na.omit)))

##                                Df Sum Sq Mean Sq F value Pr(>F)
## TestResult                     1    4.2    4.153    0.670 0.416
## Design                         1    1.6    1.608    0.259 0.612
## TestResult:Design              1    1.1    1.071    0.173 0.679
## Residuals                      79 489.9    6.201
```

```
print(summary(aov(subj.understanding ~ TestResult * Design, data = no_uni,
na.action=na.omit)))
```

```
##              Df Sum Sq Mean Sq F value Pr(>F)
## TestResult      1   0.40   0.403   0.249 0.6194
## Design          1  10.93  10.933   6.737 0.0113 *
## TestResult:Design 1   0.02   0.022   0.013 0.9081
## Residuals      79 128.21   1.623
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
print(summary(aov(communication.efficacy ~ TestResult * Design, data =
no_uni, na.action=na.omit)))
```

```
##              Df Sum Sq Mean Sq F value    Pr(>F)
## TestResult      1  0.168   0.168   0.424    0.517
## Design          1  9.003   9.003  22.760 8.26e-06 ***
## TestResult:Design 1  0.008   0.008   0.021    0.886
## Residuals      79 31.250   0.396
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
print(summary(aov(subj.clarity ~ TestResult * Design, data = no_uni,
na.action=na.omit)))
```

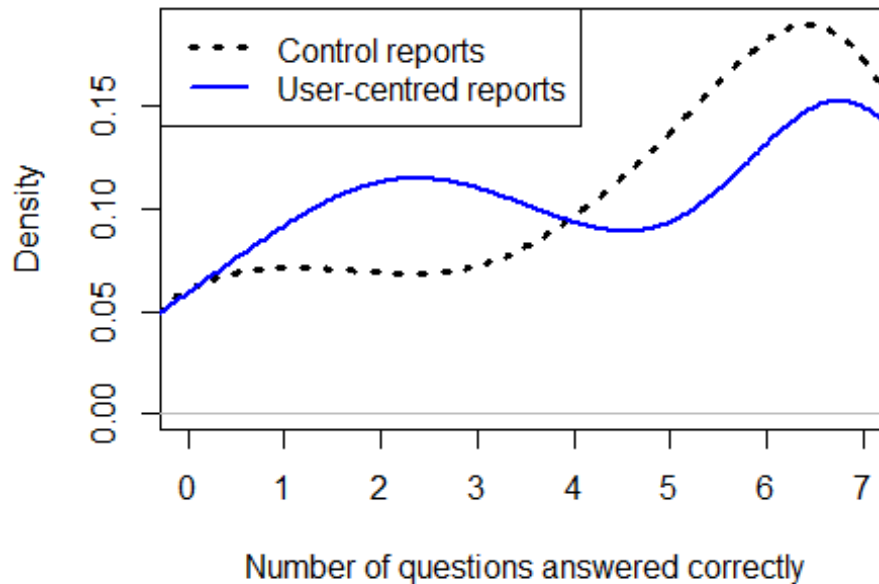
```
##              Df Sum Sq Mean Sq F value    Pr(>F)
## TestResult      1   1.31   1.31   0.779    0.380
## Design          1  33.06  33.06  19.612 3.01e-05 ***
## TestResult:Design 1   2.74   2.74   1.624    0.206
## Residuals      79 133.16   1.69
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
analyse.by.design(no_uni, "oc.score", "No_Uni Risk probability
comprehension", xlim=c(0, 7), xlab="Number of questions answered correctly")
```

```
## *****
## No_Uni Risk probability comprehension
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 7L, 7L, 4L, 5L, 4L, 0L, 5L, 1L, :
## cannot compute exact p-value with ties
```

## No\_Uni Risk probability comprehension



## Mann-Whitney U test did not report a significant difference ( $\alpha = 0.01$ ) between user-centered report ( $M_{uc}=4.29$ ,  $SD_{uc}=2.53$ ) and standard report ( $M_{standard}=4.61$ ,  $SD_{standard}=2.43$ ),  $U=872.000$ ,  $p = 0.716$ , Cohen's  $d = -0.13$

```
analyse.by.design(no_uni, "subj.understanding", "No_Uni Subjective
comprehension", xlim=c(1, 7))
```

```
## *****
```

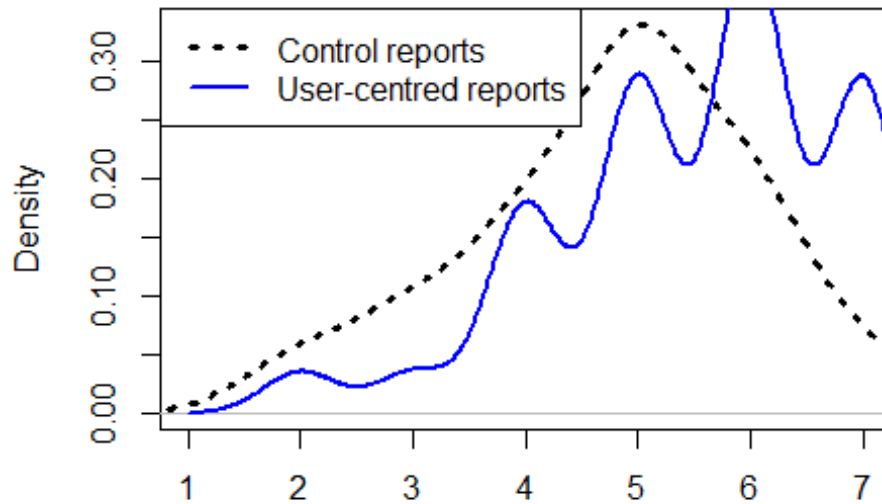
```
## No_Uni Subjective comprehension
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(5L, 5L, 7L, 7L, 6L, 4L, 2L, 6L, 4L, :
```

```
## cannot compute exact p-value with ties
```

## No\_Uni Subjective comprehension



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
## between user-centered report (M_uc=5.50, SD_uc=1.26) and standard report
## (M_standard=4.78, SD_standard=1.26), U=563.000, p = 0.010, Cohen's d = 0.57
```

```
analyse.by.design(no_uni, "subj.clarity", "No_Uni Subjective clarity", bw=.5,
ylim=c(0,.4))
```

```
## *****
```

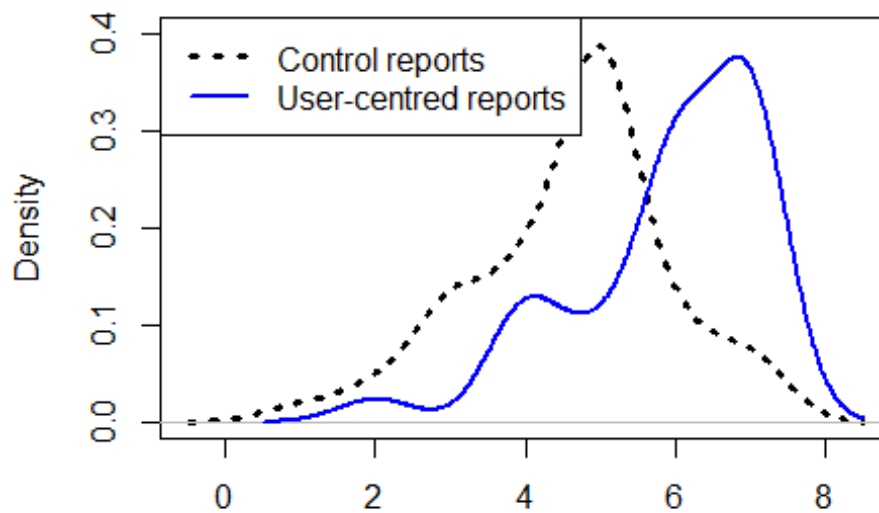
```
## No_Uni Subjective clarity
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(5L, 5L, 7L, 7L, 5L, 5L, 1L, 6L, 5L, :
## cannot compute exact p-value with ties
```



### No\_Uni Subjective clarity



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
## between user-centered report (M_uc=5.91, SD_uc=1.26) and standard report
## (M_standard=4.61, SD_standard=1.32), U=381.500, p = 0.000, Cohen's d = 1.00
```

```
analyse.by.design(no_uni, "communication.efficacy", "No_Uni Communication
efficacy", xlim=c(1, 4), ylim=c(0,.7))
```

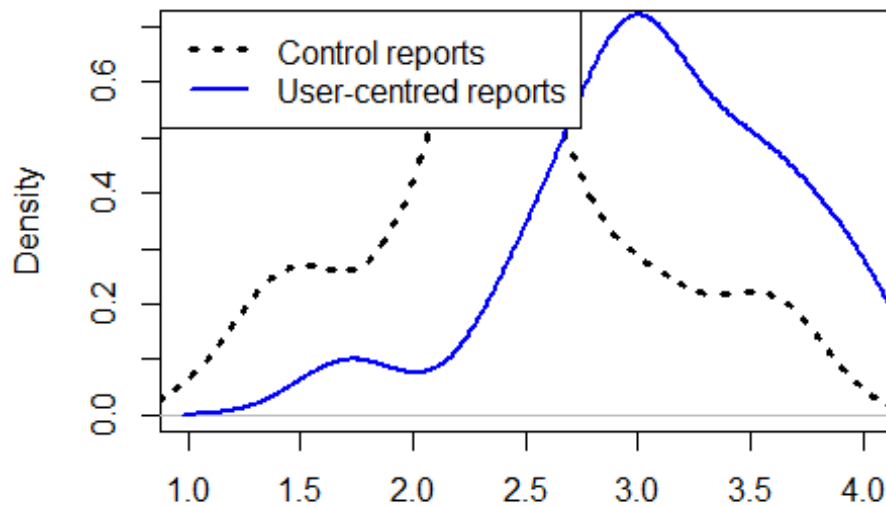
```
## *****
```

```
## No_Uni Communication efficacy
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(2.5, 3.111111111111111,
## 3.777777777777778, : cannot compute exact p-value with ties
```

## No\_Uni Communication efficacy



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.10, SD_uc=0.57) and standard report
(M_standard=2.43, SD_standard=0.65), U=353.500, p = 0.000, Cohen's d = 1.09
```

```
analyse.by.design(no_uni, "Next.Steps.Average", "No_Uni Actionability",
xlim=c(1, 7), ylim=c(0,.35))
```

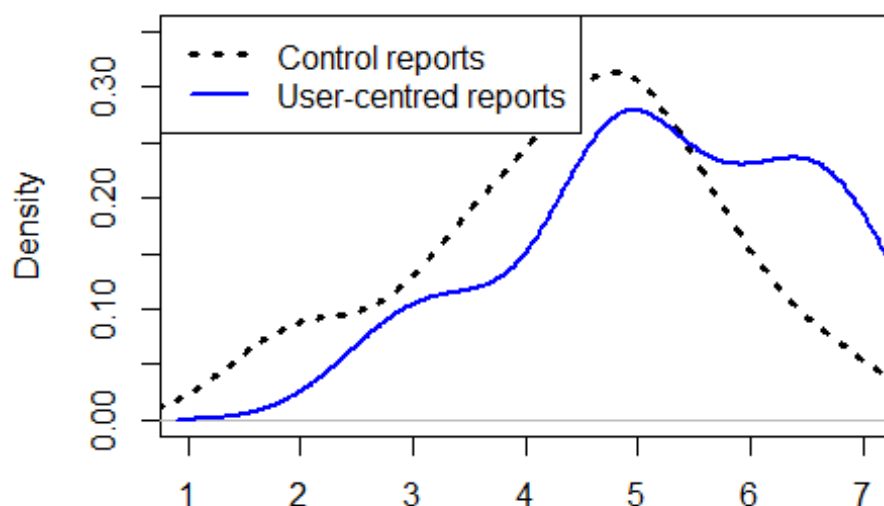
```
## *****
```

```
## No_Uni Actionability
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(3, 6.8, 6.6, 6, 5.6, 4.8, 2.2, 6.2, :
## cannot compute exact p-value with ties
```

## No\_Uni Actionability



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
## between user-centered report (M_uc=5.23, SD_uc=1.29) and standard report
## (M_standard=4.41, SD_standard=1.33), U=554.000, p = 0.010, Cohen's d = 0.62
```

```
analyse.by.design(no_uni, "Result.Understood.Value", "No_Uni How easy is it
to understand the result summary?", xlim=c(1, 7), bw=.45, ylim=c(0,.55))
```

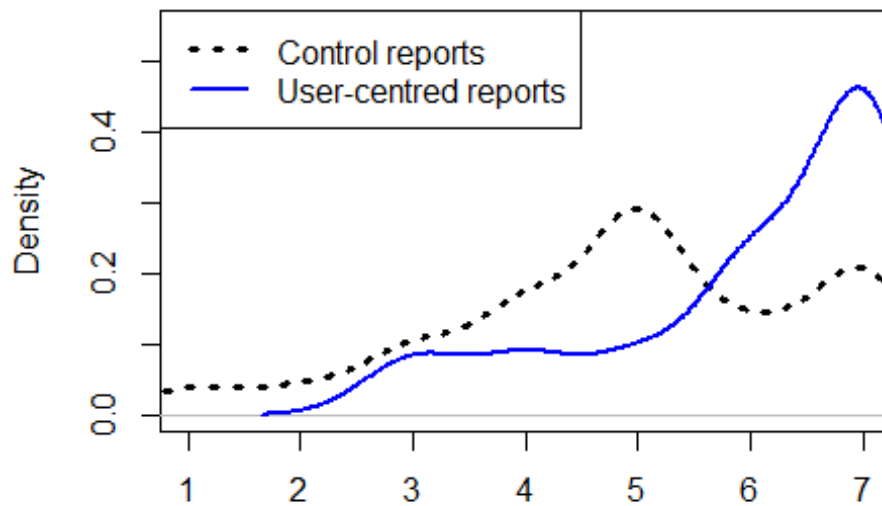
```
## *****
```

```
## No_Uni How easy is it to understand the result summary?
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 5L, 7L, 7L, 7L, 4L, 1L, 7L, 5L, :
## cannot compute exact p-value with ties
```

## Vo\_Uni How easy is it to understand the result summ



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.97, SD_uc=1.34) and standard report
(M_standard=4.92, SD_standard=1.63), U=514.500, p = 0.002, Cohen's d = 0.69
```

```
low_sns = filter(d, d$subjective.numeracy < 4.2)
```

```
analyse.by.design(low_sns, "oc.score", "Low_SNS Risk probability
comprehension", xlim=c(0, 7), xlab="Number of questions answered correctly")
```

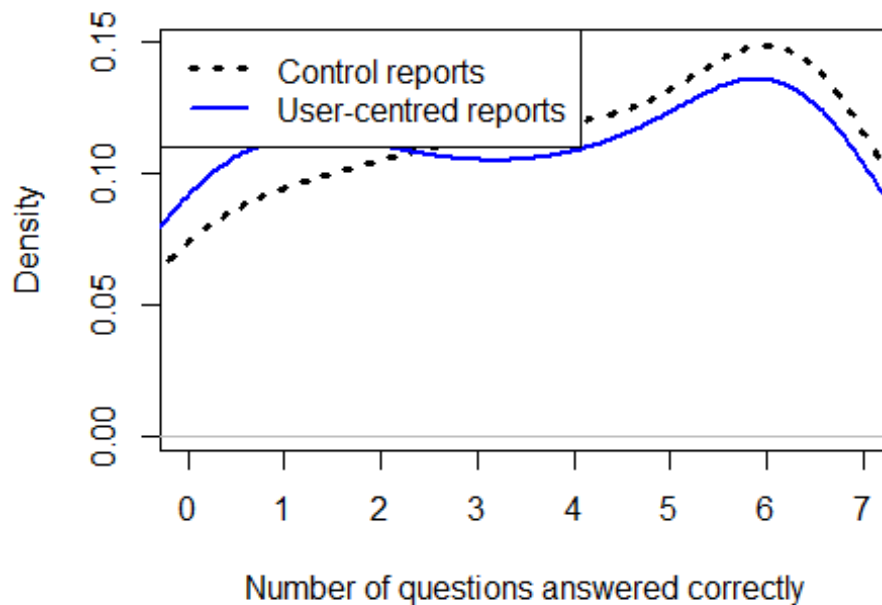
```
## *****
```

```
## Low_SNS Risk probability comprehension
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 4L, 2L, 4L, 3L, 6L, 7L, 1L, 0L, :
## cannot compute exact p-value with ties
```

## Low\_SNS Risk probability comprehension



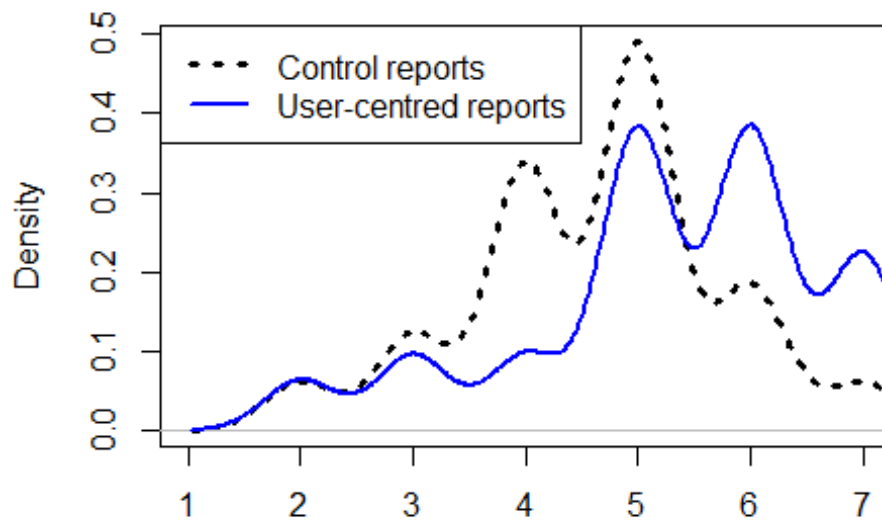
```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
## between user-centered report (M_uc=3.62, SD_uc=2.46) and standard report
## (M_standard=3.90, SD_standard=2.36), U=853.000, p = 0.606, Cohen's d = -0.12
```

```
analyse.by.design(low_sns, "subj.understanding", "Low_SNS Subjective
comprehension", xlim=c(1, 7))
```

```
## *****
## Low_SNS Subjective comprehension
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 7L, 6L, 4L, 5L, 5L, 5L, 4L, 3L, :
## cannot compute exact p-value with ties
```

## Low\_SNS Subjective comprehension



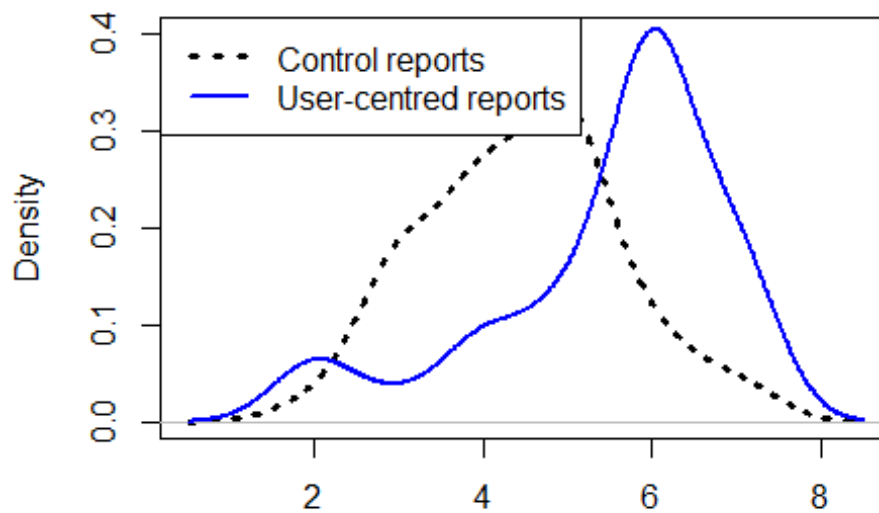
```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.28, SD_uc=1.36) and standard report
(M_standard=4.63, SD_standard=1.16), U=538.500, p = 0.010, Cohen's d = 0.52
```

```
analyse.by.design(low_sns, "subj.clarity", "Low_SNS Subjective clarity",
bw=.5, ylim=c(0,.4))
```

```
## *****
## Low_SNS Subjective clarity
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 7L, 6L, 5L, 4L, 3L, 5L, 5L, 4L, :
## cannot compute exact p-value with ties
```

### Low\_SNS Subjective clarity



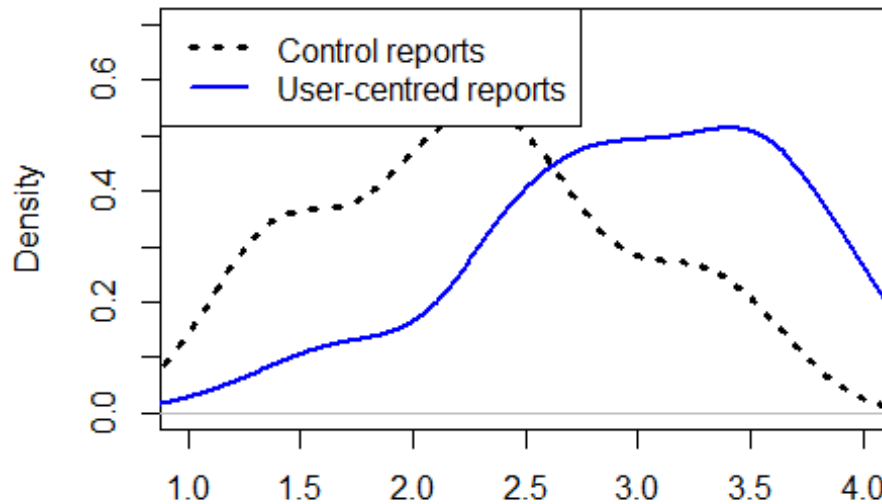
```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.49, SD_uc=1.41) and standard report
(M_standard=4.46, SD_standard=1.14), U=411.000, p = 0.000, Cohen's d = 0.80
```

```
analyse.by.design(low_sns, "communication.efficacy", "Low_SNS Communication
efficacy", xlim=c(1, 4), ylim=c(0,.7))
```

```
## *****
## Low_SNS Communication efficacy
## *****
```

```
## Warning in wilcox.test.default(x = c(3.33333333333333, 3.61111111111111, :
## cannot compute exact p-value with ties
```

## Low\_SNS Communication efficacy



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=2.99, SD_uc=0.69) and standard report
(M_standard=2.29, SD_standard=0.69), U=368.500, p = 0.000, Cohen's d = 1.03
```

```
analyse.by.design(low_sns, "Next.Steps.Average", "Low_SNS Actionability",
xlim=c(1, 7), ylim=c(0,.35))
```

```
## *****
```

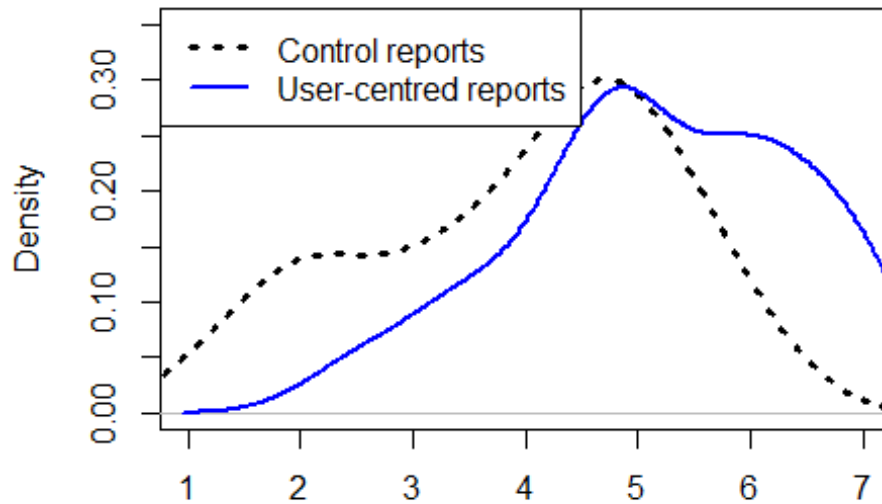
```
## Low_SNS Actionability
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(4.6, 6, 4, 4.8, 3.2, 2.2, 4.6, 5.6, :
## cannot compute exact p-value with ties
```



## Low\_SNS Actionability



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.17, SD_uc=1.25) and standard report
(M_standard=3.97, SD_standard=1.35), U=420.000, p = 0.000, Cohen's d = 0.93
```

```
analyse.by.design(low_sns, "Result.Understood.Value", "Low_SNS How easy is it
to understand the result summary?", xlim=c(1, 7), bw=.45, ylim=c(0,.55))
```

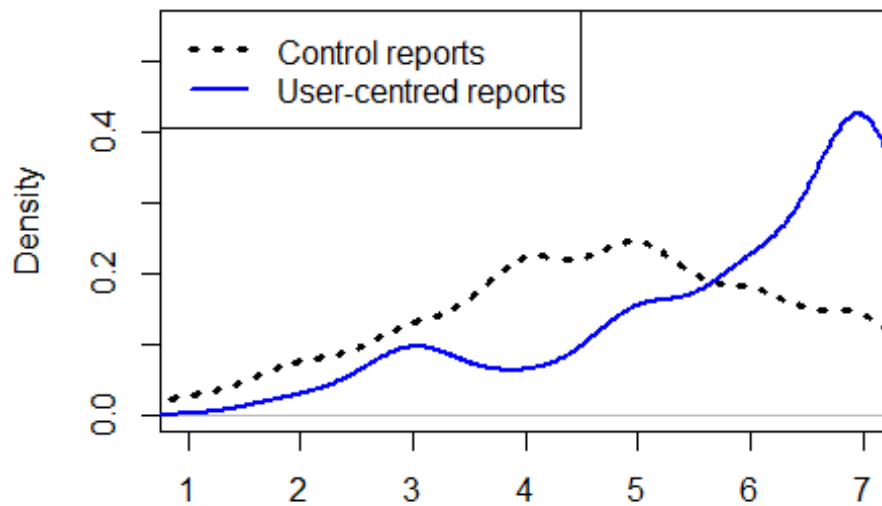
```
## *****
```

```
## Low_SNS How easy is it to understand the result summary?
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 7L, 5L, 4L, 3L, 6L, 6L, 5L, 4L, :
## cannot compute exact p-value with ties
```

## ow\_SNS How easy is it to understand the result sumr



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.79, SD_uc=1.47) and standard report
(M_standard=4.68, SD_standard=1.57), U=469.500, p = 0.001, Cohen's d = 0.73
```

```
men = filter(d, d$Gender.Value == "Male")
```

```
analyse.by.design(men, "oc.score", "MEN Risk probability comprehension",
xlim=c(0, 7), xlab="Number of questions answered correctly")
```

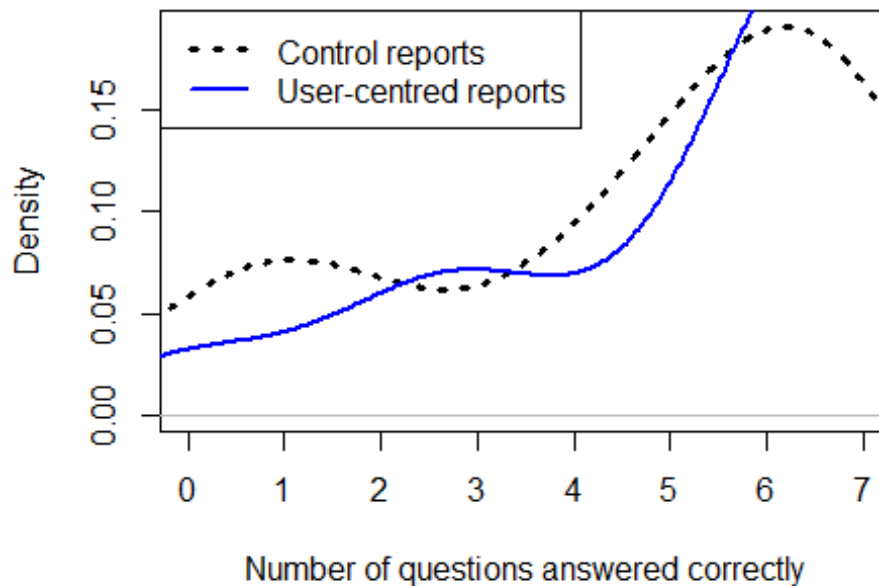
```
## *****
```

```
## MEN Risk probability comprehension
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 5L, 1L, 4L, 0L, 1L, 4L, 7L, 1L, :
## cannot compute exact p-value with ties
```

## MEN Risk probability comprehension



```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.29, SD_uc=2.23) and standard report
(M_standard=4.63, SD_standard=2.40), U=303.500, p = 0.199, Cohen's d = 0.28
```

```
analyse.by.design(men, "subj.understanding", "MEN Subjective comprehension",
xlim=c(1, 7))
```

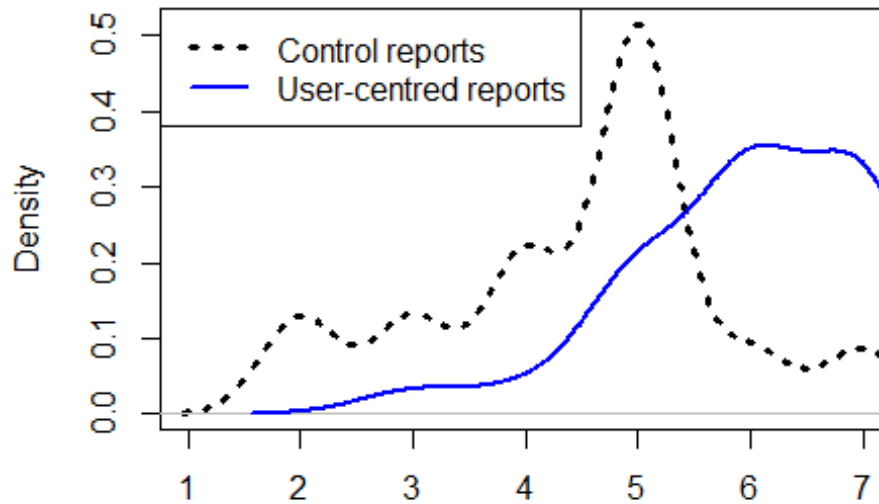
```
## *****
```

```
## MEN Subjective comprehension
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(5L, 5L, 3L, 4L, 2L, 4L, 5L, 5L, 6L, :
## cannot compute exact p-value with ties
```

## MEN Subjective comprehension



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.96, SD_uc=1.04) and standard report
(M_standard=4.48, SD_standard=1.34), U=141.000, p = 0.000, Cohen's d = 1.24
```

```
analyse.by.design(men, "subj.clarity", "MEN Subjective clarity", bw=.5,
ylim=c(0,.4))
```

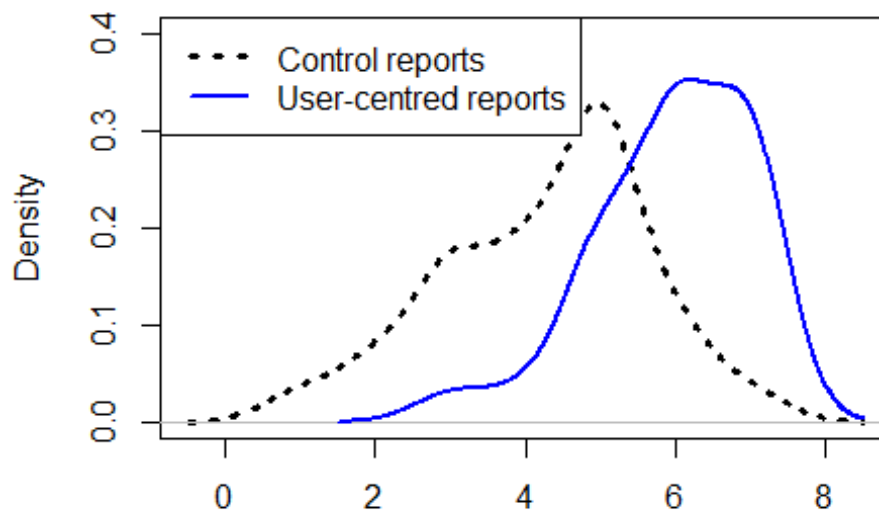
```
## *****
```

```
## MEN Subjective clarity
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(5L, 5L, 3L, 5L, 1L, 5L, 5L, 4L, 5L, :
## cannot compute exact p-value with ties
```

## MEN Subjective clarity



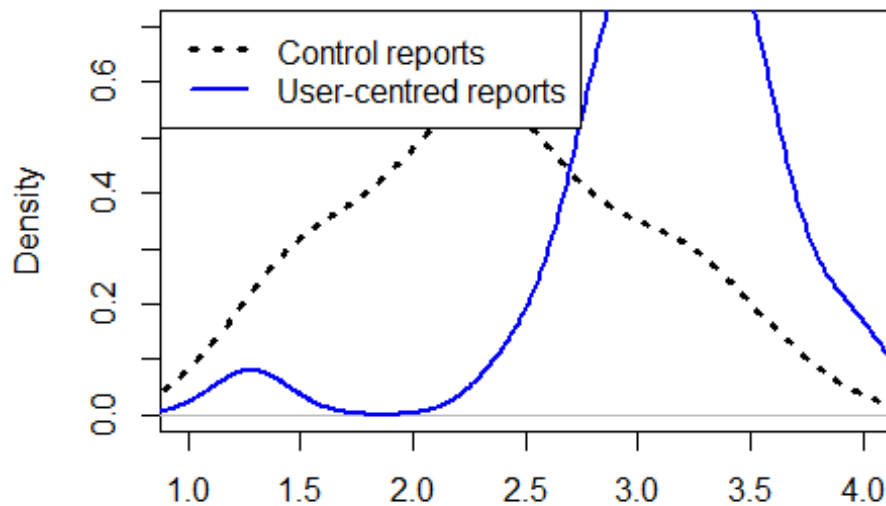
```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.96, SD_uc=1.04) and standard report
(M_standard=4.26, SD_standard=1.40), U=122.000, p = 0.000, Cohen's d = 1.39
```

```
analyse.by.design(men, "communication.efficacy", "MEN Communication
efficacy", xlim=c(1, 4), ylim=c(0,.7))
```

```
## *****
## MEN Communication efficacy
## *****
```

```
## Warning in wilcox.test.default(x = c(2.72222222222222, 2.22222222222222, :
## cannot compute exact p-value with ties
```

## MEN Communication efficacy



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.14, SD_uc=0.51) and standard report
(M_standard=2.38, SD_standard=0.64), U=132.500, p = 0.000, Cohen's d = 1.32
```

```
analyse.by.design(men, "Next.Steps.Average", "MEN Actionability", xlim=c(1,
7), ylim=c(0,.35))
```

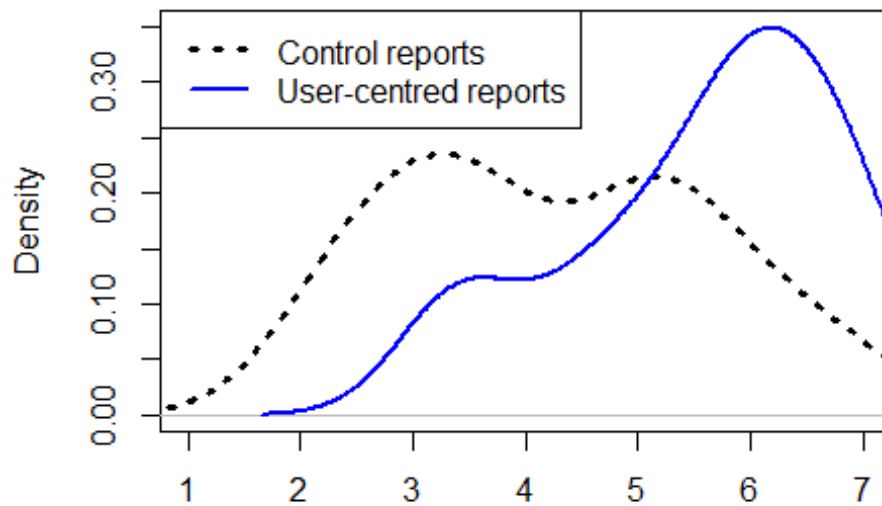
```
## *****
```

```
## MEN Actionability
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(5.2, 2.6, 2.4, 4.8, 2.2, 5.6, 3.4, :
## cannot compute exact p-value with ties
```

## MEN Actionability



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.56, SD_uc=1.18) and standard report
(M_standard=4.28, SD_standard=1.40), U=184.500, p = 0.001, Cohen's d = 0.99
```

```
analyse.by.design(men, "Result.Understood.Value", "MEN How easy is it to
understand the result summary?", xlim=c(1, 7), bw=.45, ylim=c(0,.55))
```

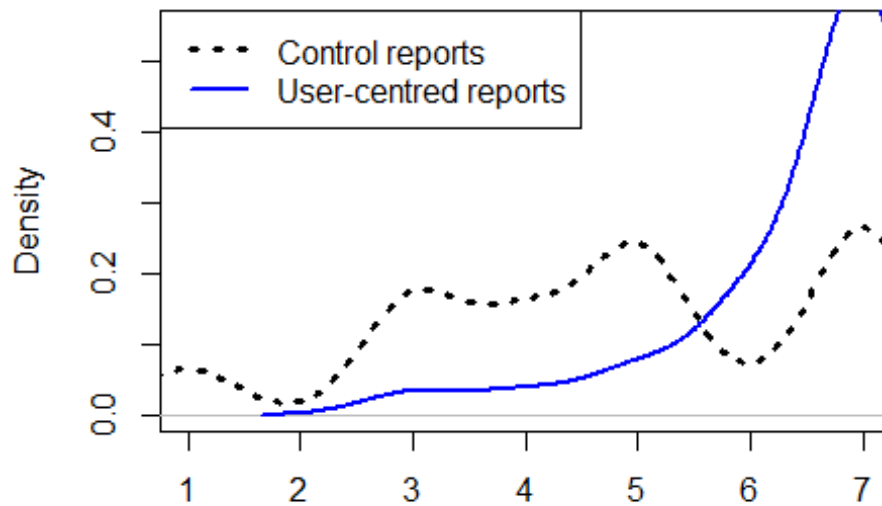
```
## *****
```

```
## MEN How easy is it to understand the result summary?
```

```
## *****
```

```
## Warning in wilcox.test.default(x = c(7L, 3L, 5L, 4L, 1L, 5L, 4L, 5L, 7L, :
## cannot compute exact p-value with ties
```

## MEN How easy is it to understand the result summa



```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=6.43, SD_uc=1.03) and standard report
(M_standard=4.81, SD_standard=1.84), U=184.000, p = 0.000, Cohen's d = 1.09
```

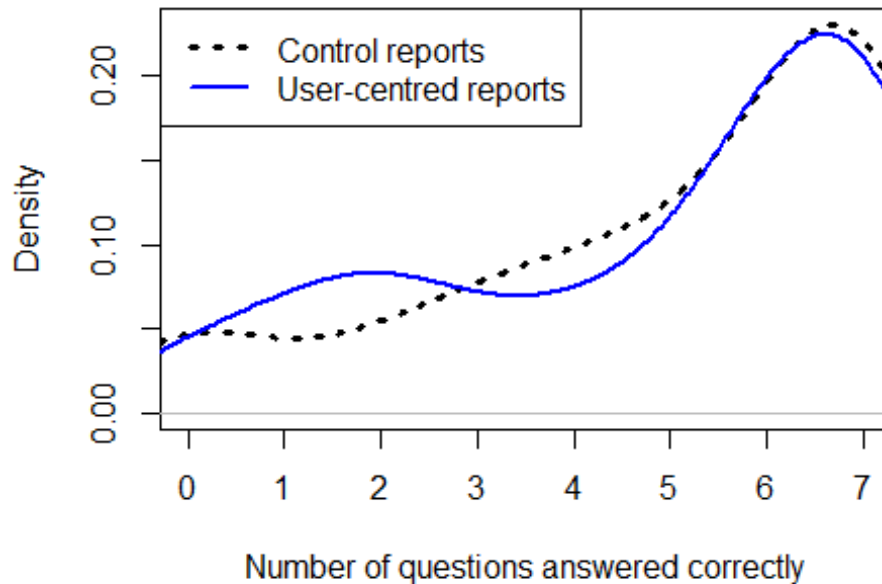
```
women = filter(d, d$Gender.Value == "Female")
```

```
analyse.by.design(women, "oc.score", "WOMEN Risk probability comprehension",
xlim=c(0, 7), xlab="Number of questions answered correctly")
```

```
## *****
## WOMEN Risk probability comprehension
## *****
```



## WOMEN Risk probability comprehension

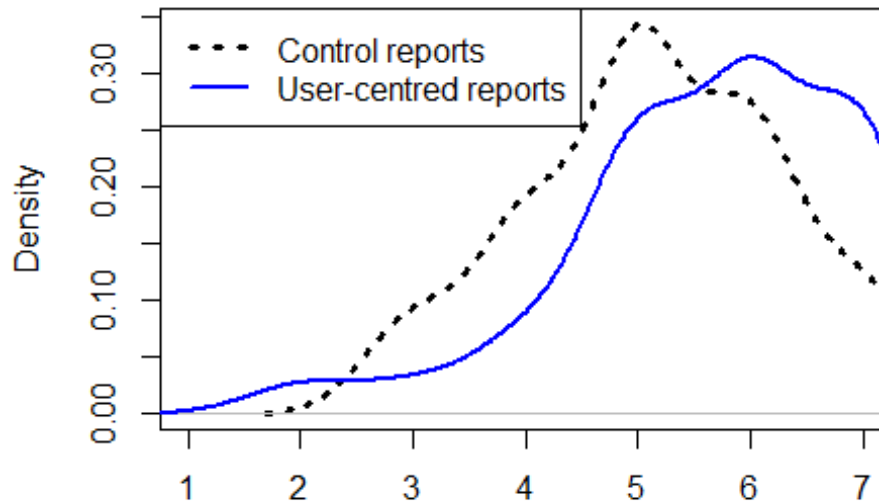


```
## Mann-Whitney U test did not report a significant difference (alpha = 0.01)
between user-centered report (M_uc=4.87, SD_uc=2.34) and standard report
(M_standard=5.00, SD_standard=2.28), U=2315.500, p = 0.746, Cohen's d = -0.06
```

```
analyse.by.design(women, "subj.understanding", "WOMEN Subjective
comprehension", xlim=c(1, 7))
```

```
## *****
## WOMEN Subjective comprehension
## *****
```

## WOMEN Subjective comprehension

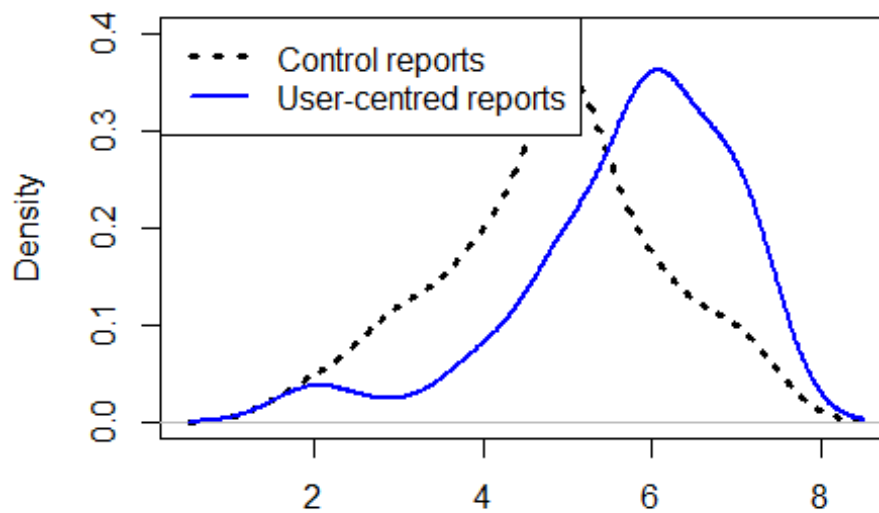


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.66, SD_uc=1.23) and standard report
(M_standard=5.15, SD_standard=1.13), U=1645.000, p = 0.006, Cohen's d = 0.43
```

```
analyse.by.design(women, "subj.clarity", "WOMEN Subjective clarity", bw=.5,
ylim=c(0,.4))
```

```
## *****
## WOMEN Subjective clarity
## *****
```

## WOMEN Subjective clarity

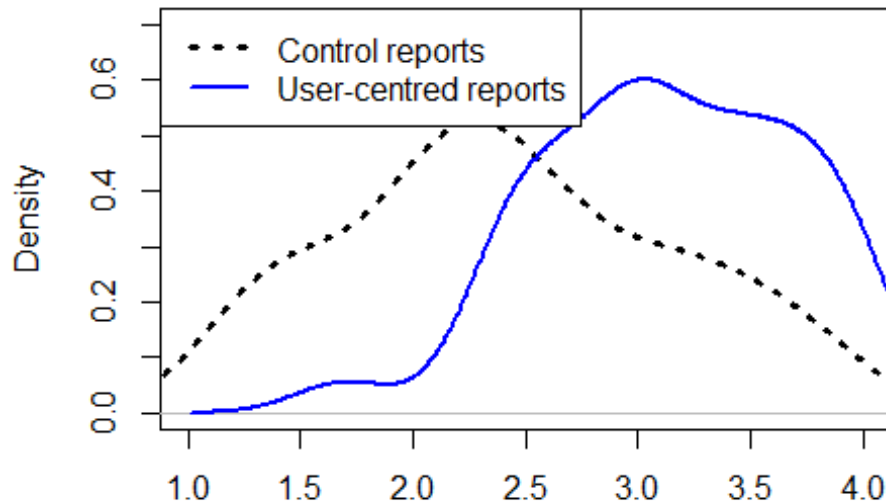


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.72, SD_uc=1.25) and standard report
(M_standard=4.81, SD_standard=1.27), U=1281.500, p = 0.000, Cohen's d = 0.72
```

```
analyse.by.design(women, "communication.efficacy", "WOMEN Communication
efficacy", xlim=c(1, 4), ylim=c(0,.7))
```

```
## *****
## WOMEN Communication efficacy
## *****
```

## WOMEN Communication efficacy

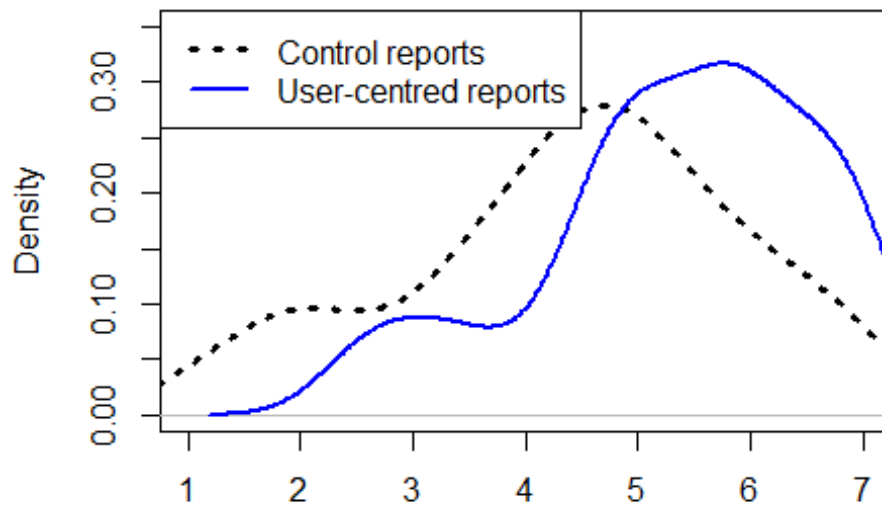


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=3.13, SD_uc=0.56) and standard report
(M_standard=2.43, SD_standard=0.73), U=1010.500, p = 0.000, Cohen's d = 1.08
```

```
analyse.by.design(women, "Next.Steps.Average", "WOMEN Actionability",
xlim=c(1, 7), ylim=c(0,.35))
```

```
## *****
## WOMEN Actionability
## *****
```

## WOMEN Actionability

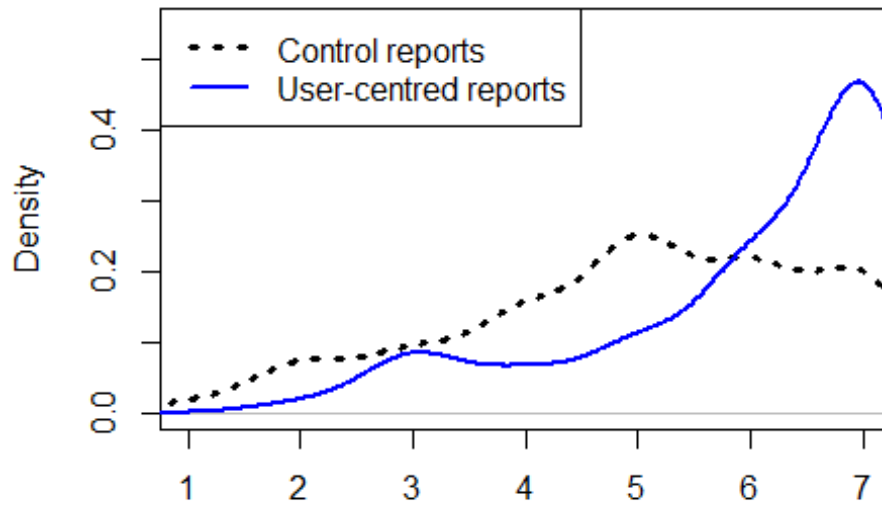


```
## Mann-Whitney U test reported a significant difference (alpha = 0.01)
between user-centered report (M_uc=5.35, SD_uc=1.23) and standard report
(M_standard=4.42, SD_standard=1.51), U=1412.500, p = 0.000, Cohen's d = 0.67
```

```
analyse.by.design(women, "Result.Understood.Value", "WOMEN How easy is it to
understand the result summary?", xlim=c(1, 7), bw=.45, ylim=c(0,.55))
```

```
## *****
## WOMEN How easy is it to understand the result summary?
## *****
```

## WOMEN How easy is it to understand the result summary



## Mann-Whitney U test reported a significant difference ( $\alpha = 0.01$ ) between user-centered report ( $M_{uc}=5.96$ ,  $SD_{uc}=1.39$ ) and standard report ( $M_{standard}=5.01$ ,  $SD_{standard}=1.58$ ),  $U=1420.000$ ,  $p = 0.000$ , Cohen's  $d = 0.63$