# Mémoire d'Anne Weiss: score deLikert

*jcb*

*24 juin 2015*

## Contents



## 1 Lecture des fichiers

```
## Loading required package: ggplot2
## Loading required package: xtable
```

Fichier des apprenants:

```
 [1] "ID_Etud"                       "Groupe_ID"
 [3] "SMI"                           "FDP"
 [5] "FMN"                           "PROF"
 [7] "ETUDE"                         "SEXE"
 [9] "ROLE"                          "Nature.de.la.formation..NAT."
[11] "PREB"
```

Questionnaire "avant" (lk.av):

```
 [1] "DATE"      "ID_Etud"   "Groupe_ID" "Q1.av"     "Q2.av"
 [6] "Q3.av"     "Q4.av"     "Q5.av"     "Q6.av"     "Q7.av"
[11] "Q8.av"     "Q9.av"     "Q10.av"    "Q11.av"    "Q12.av"
```

Questionnaire après (lk.ap):

```
 [1] "DATE"      "ID_Etud"   "Groupe_ID" "Q1.ap"     "Q2.ap"
 [6] "Q3.ap"     "Q4.ap"     "Q5.ap"     "Q6.ap"     "Q7.ap"
[11] "Q8.ap"     "Q9.ap"     "Q10.ap"    "Q11.ap"    "Q12.ap"
```

Les items de Likert correspondent aux colonnes 4 à 15

On forme un fichier global par combinaison des questionnaires *avant* et *après*. Ajout d'une colonne **PREB** (O/N) pour identifier le groupe ayant bénéficié d'un prébriefing.

```
 [1] "DATE"      "ID_Etud"   "Groupe_ID" "Q1.av"     "Q2.av"
 [6] "Q3.av"     "Q4.av"     "Q5.av"     "Q6.av"     "Q7.av"
[11] "Q8.av"     "Q9.av"     "Q10.av"    "Q11.av"    "Q12.av"
[16] "Q1.ap"     "Q2.ap"     "Q3.ap"     "Q4.ap"     "Q5.ap"
[21] "Q6.ap"     "Q7.ap"     "Q8.ap"     "Q9.ap"     "PREB"
```

## 2 Analyse des groupes avec et sans prebriefing

Toutes les caractéristiques des groupes sont de nature qualitative. Le test approprié pour les comparer est le test du Chi2. Cependant les effectifs sont faibles et lorsque les conditions d'application du chi2 ne sont pas respectées, des effectifs ont été regroupés (années d'étude) et/ou le test exact de Fisher a été utilisé. Les goupes sont considérés comme différents si *p-value* est plus petite que 0.05.

```
# sexe
table(app$SEXE, app$PREB)
```

```
##
##      N  O
##   F 17 17
##   M 12 10
```

```
chisq.test(table(app$SEXE, app$PREB, dnn = c("Sexe", "PREB")))
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  table(app$SEXE, app$PREB, dnn = c("Sexe", "PREB"))
## X-squared = 0.0034, df = 1, p-value = 0.9532
```

```
# SMI situation de mort inattendue
table(app$SMI, app$PREB, dnn = c("SMI", "PREB"))
```

```
##                            PREB
## SMI                          N  O
##   jamais                     4  5
##   plusieurs fois par an     22 18
##   plusieurs fois par mois    3  2
##   plusieurs fois par semaine 0  2
```

```r
fisher.test(table(app$SMI, app$PREB))
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  table(app$SMI, app$PREB)
## p-value = 0.5573
## alternative hypothesis: two.sided
```

```r
# FDP formation décès patient
table(app$FDP, app$PREB, dnn = c("FDP", "PREB"))
```

```
##    PREB
## FDP  N  O
##   N 16 20
##   O 13  7
```

```r
chisq.test(table(app$FDP, app$PREB))
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  table(app$FDP, app$PREB)
## X-squared = 1.43, df = 1, p-value = 0.2317
```

```r
# FMN formation annonce mauvaise nouvelle
table(app$FMN, app$PREB, dnn = c("FMN", "PREB"))
```

```
##    PREB
## FMN  N  O
##   N  7 16
##   O 22 11
```

```r
chisq.test(table(app$FMN, app$PREB))
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  table(app$FMN, app$PREB)
## X-squared = 5.75, df = 1, p-value = 0.0165
```

```r
# PROF profession
table(app$PROF, app$PREB, dnn = c("PROF", "PREB"))
```

```
##           PREB
## PROF        N  O
##   DESC AN   4  1
##   DESC MU   0  1
##   ETUDIANT 25 25
```

```r
fisher.test(table(app$SMI, app$PREB, dnn = c("Profession", "PREB")))
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  table(app$SMI, app$PREB, dnn = c("Profession", "PREB"))
## p-value = 0.5573
## alternative hypothesis: two.sided
```

```r
# ROLE
table(app$ROLE, app$PREB, dnn = c("ROLE", "PREB"))
```

```
##              PREB
## ROLE           N  O
##   EXTERNE      6  6
##   IDE          3  3
##   INTERNE      4  4
##   OBSERVATEUR 16 14
```

```r
fisher.test(table(app$ROLE, app$PREB, dnn = c("ROLE", "PREB")))
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  table(app$ROLE, app$PREB, dnn = c("ROLE", "PREB"))
## p-value = 1
## alternative hypothesis: two.sided
```

```r
# Années d'étude ETUDE
table(app$ETUDE, app$PREB, dnn = c("Années d'études", "PREB"))
```

```
##                PREB
## Années d'études  N  O
##               1  0  1
##               3  0  1
##               4  4  0
##               6 25 18
##               7  0  3
##               8  0  3
```

```r
# regroupement
t <- table(app$ETUDE, app$PREB)
r <- rbind(apply(t[1:3,], 2, sum), apply(t[4:6,], 2, sum))
rownames(r) <- c("moins de 6 ans", "6 ans ou plus")
r
```

```
##                 N  O
## moins de 6 ans  4  2
## 6 ans ou plus  25 24
```

```r
fisher.test(r)
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  r
## p-value = 0.6723
## alternative hypothesis: true odds ratio is not equal to 1
## 95 percent confidence interval:
##   0.245 22.813
## sample estimates:
## odds ratio
##        1.9
```

Conclusion: les groupes avec et sans prébriefing ne sont pas différents saf en ce qui concerne la formation à l'annonce d'une mauvaise nouvelle.

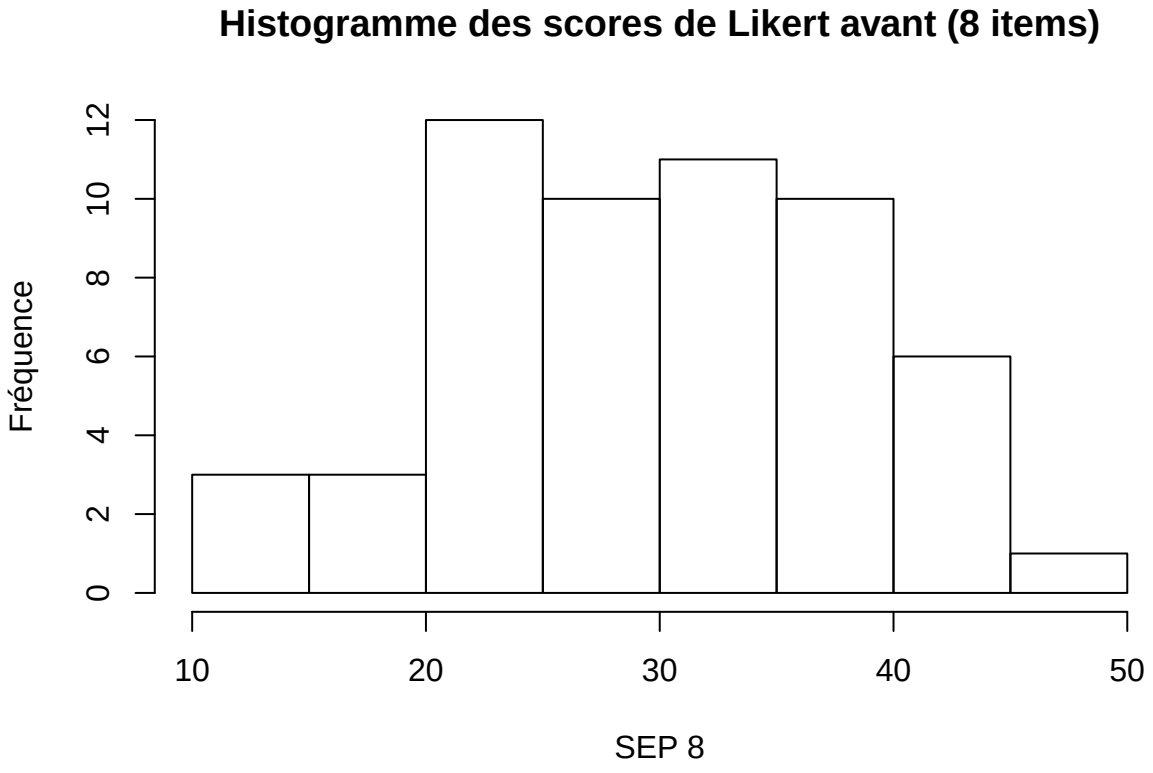
# 3 Analyse du sentiment d'efficacité personnel (SEP)

Le SEP est mesuré sur les 8 premiers items du score de Likert.

## 3.1 Avant l'expérimentation

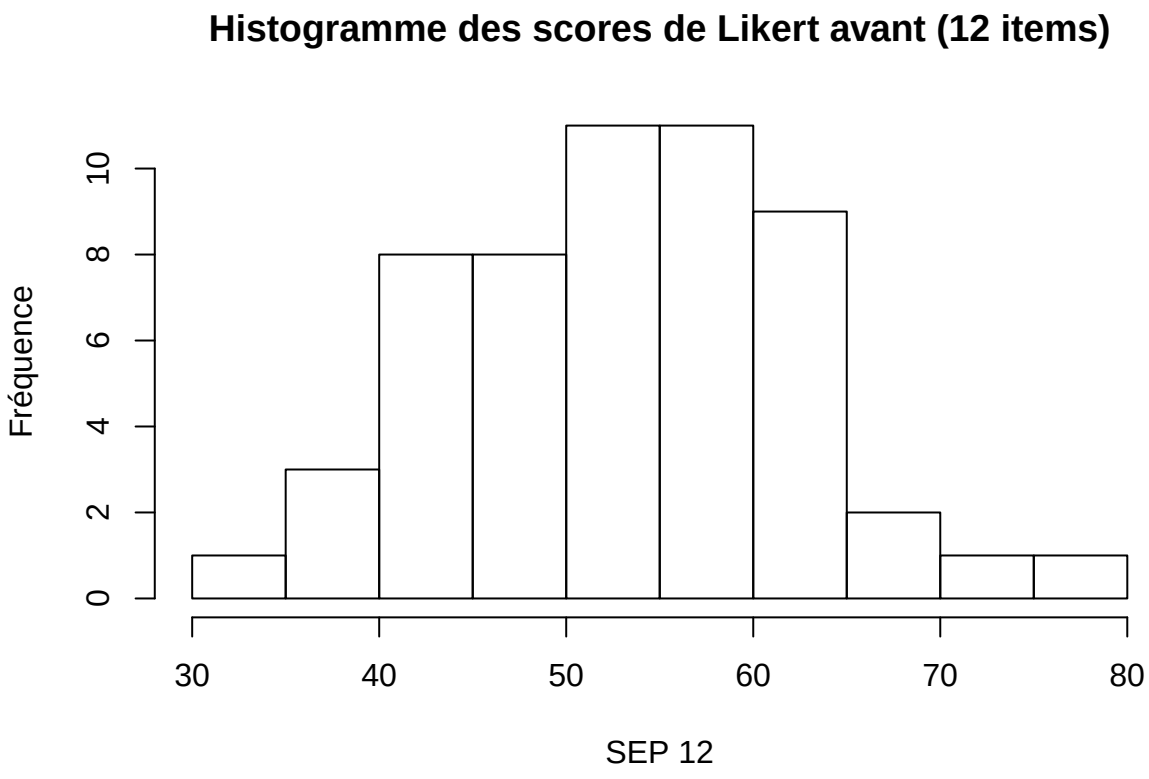
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    13.0    23.0    30.0    30.4    38.0    50.0
```

```
## [1] 8.4
```



```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##    33.0    47.0    54.0    53.7    60.0    76.0       1
```

```
## [1] NA
```



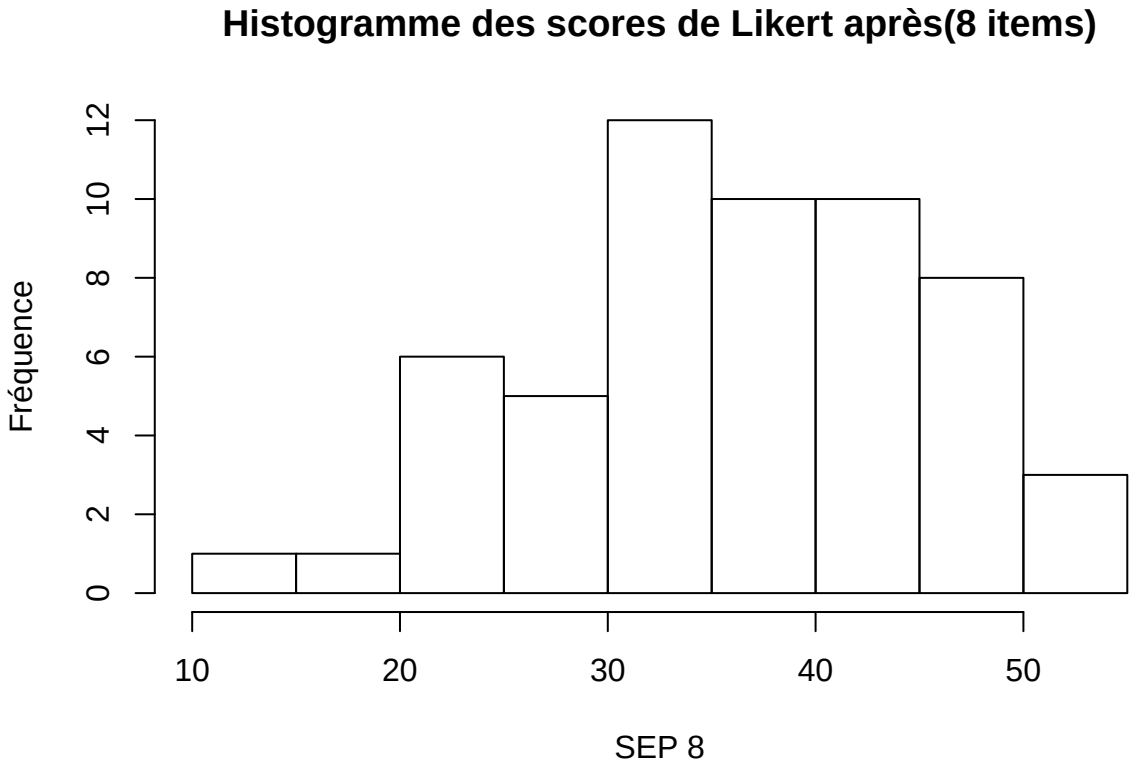

```
##
##  Welch Two Sample t-test
##
## data:  SEP8 by PREB
## t = 0.827, df = 52.9, p-value = 0.4119
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2.66  6.40
## sample estimates:
## mean in group N mean in group O
##            31.3            29.4
```

```
##
##  Welch Two Sample t-test
##
## data:  SEP12 by PREB
## t = 0.652, df = 52.3, p-value = 0.517
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -3.42  6.72
## sample estimates:
## mean in group N mean in group O
##            54.5            52.9
```

### 3.2 Après l'expérimentation

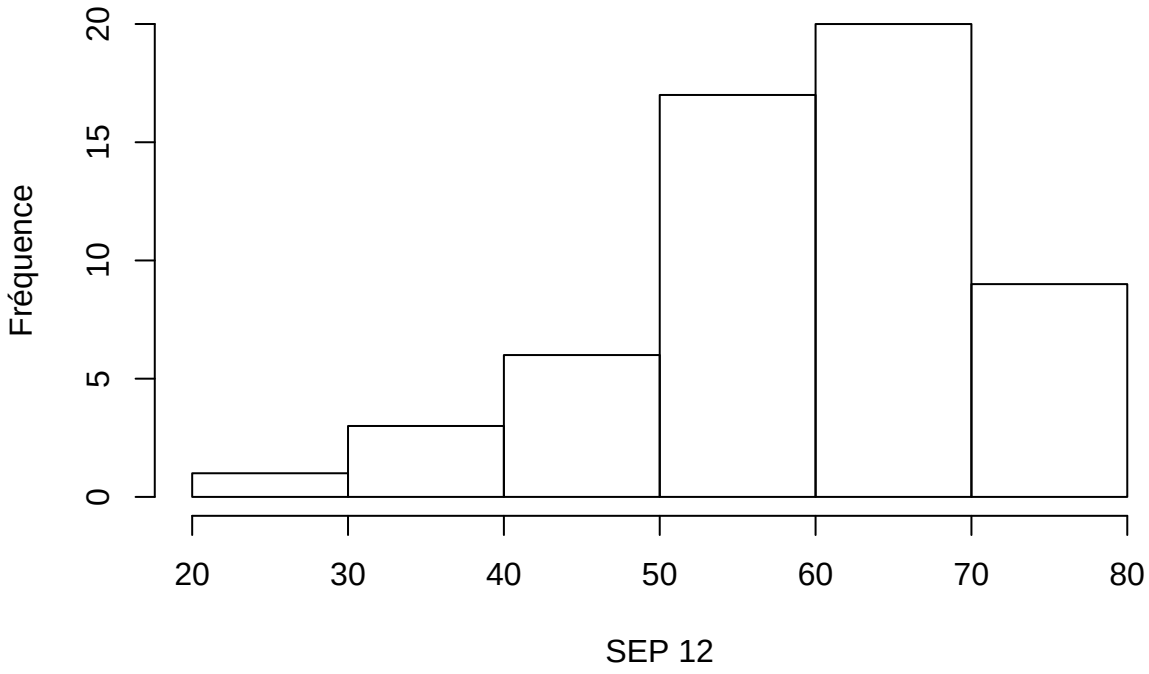
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    11.0    31.0    36.0    36.7    44.0    55.0
```

```
## [1] 9.41
```




```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    27.0    53.0    61.0    59.6    69.0    78.0
```

```
## [1] 11.1
```



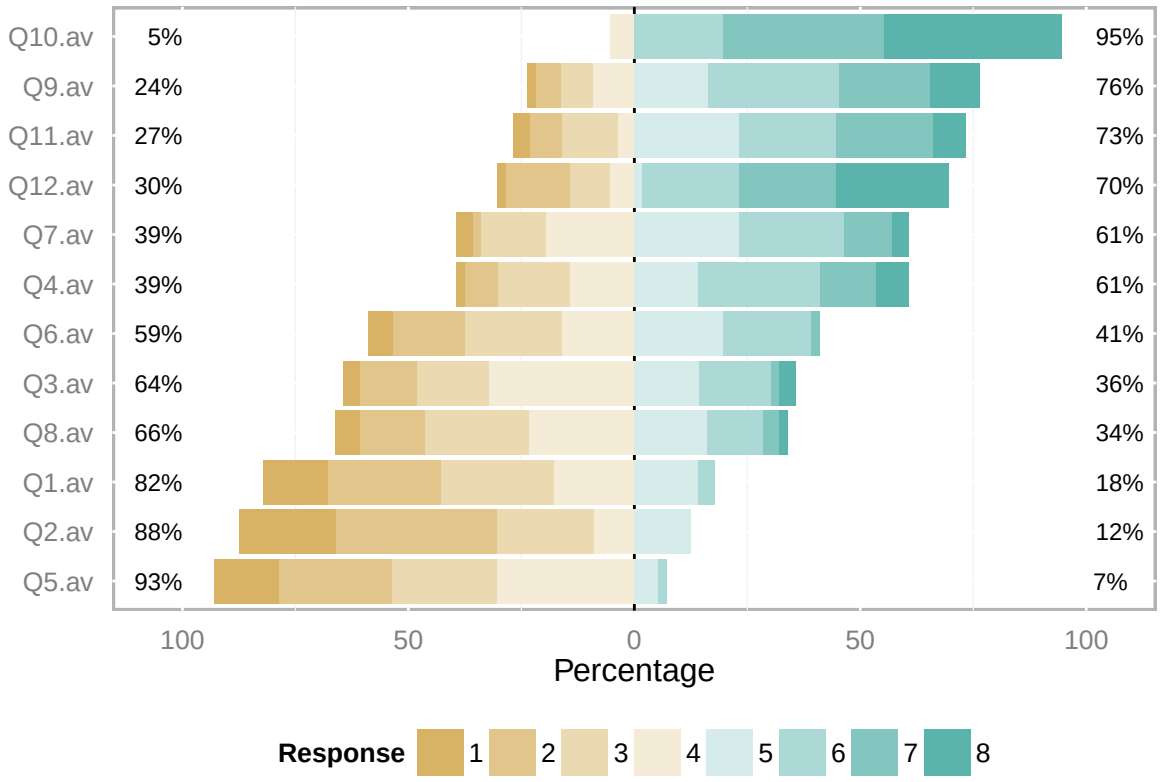

```
##
##  Welch Two Sample t-test
##
## data:  SEP8 by PREB
## t = 0.883, df = 50.5, p-value = 0.3816
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2.86  7.34
## sample estimates:
## mean in group N mean in group O
##            37.8            35.5
```

```
##
##  Welch Two Sample t-test
##
## data:  SEP12 by PREB
## t = 0.989, df = 49.8, p-value = 0.3274
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -3.05  8.98
## sample estimates:
## mean in group N mean in group O
##              61              58
```

# 4 Résultats préliminaires

## 4.1 Scores de Likert avant

```
##       Item     1     2     3     4     5     6     7     8
## 1   Q1.av 14.29 25.00 25.00 17.86 14.29  3.57  0.00  0.00
## 2   Q2.av 21.43 35.71 21.43  8.93 12.50  0.00  0.00  0.00
## 3   Q3.av  3.57 12.50 16.07 32.14 14.29 16.07  1.79  3.57
## 4   Q4.av  1.79  7.14 16.07 14.29 14.29 26.79 12.50  7.14
## 5   Q5.av 14.29 25.00 23.21 30.36  5.36  1.79  0.00  0.00
## 6   Q6.av  5.36 16.07 21.43 16.07 19.64 19.64  1.79  0.00
## 7   Q7.av  3.57  1.79 14.29 19.64 23.21 23.21 10.71  3.57
## 8   Q8.av  5.36 14.29 23.21 23.21 16.07 12.50  3.57  1.79
## 9   Q9.av  1.82  5.45  7.27  9.09 16.36 29.09 20.00 10.91
## 10 Q10.av  0.00  0.00  0.00  5.36  0.00 19.64 35.71 39.29
## 11 Q11.av  3.57  7.14 12.50  3.57 23.21 21.43 21.43  7.14
## 12 Q12.av  1.79 14.29  8.93  5.36  1.79 21.43 21.43 25.00
```

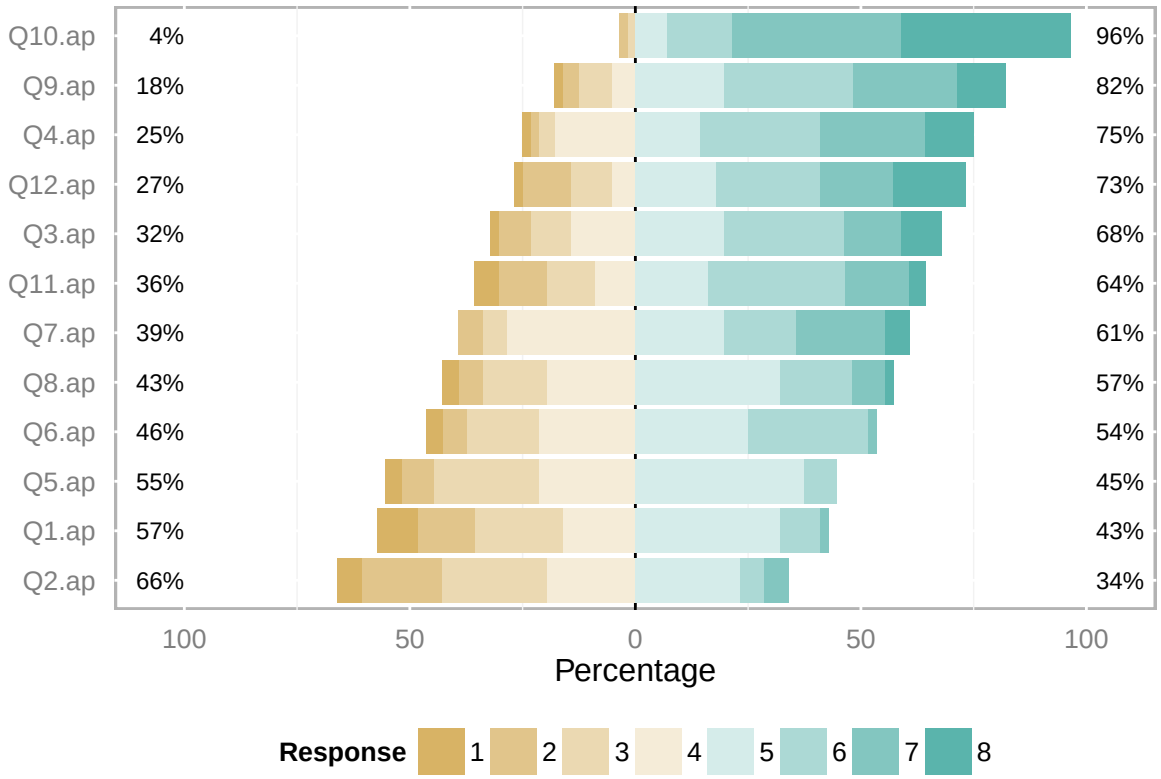



```
##       Q1.av           Q2.av           Q3.av           Q4.av
##  Min.   :1.00   Min.   :1.00   Min.   :1.00   Min.   :1.00
##  1st Qu.:2.00   1st Qu.:2.00   1st Qu.:3.00   1st Qu.:3.75
##  Median :3.00   Median :2.00   Median :4.00   Median :5.00
##  Mean   :3.04   Mean   :2.55   Mean   :4.14   Mean   :4.98
##  3rd Qu.:4.00   3rd Qu.:3.00   3rd Qu.:5.00   3rd Qu.:6.00
##  Max.   :6.00   Max.   :5.00   Max.   :8.00   Max.   :8.00
##
##       Q5.av           Q6.av           Q7.av           Q8.av
##  Min.   :1.00   Min.   :1.00   Min.   :1.00   Min.   :1.00
```

```
##  1st Qu.:2.00   1st Qu.:3.00   1st Qu.:4.00   1st Qu.:3.00
##  Median :3.00   Median :4.00   Median :5.00   Median :4.00
##  Mean   :2.93   Mean   :3.95   Mean   :4.88   Mean   :3.91
##  3rd Qu.:4.00   3rd Qu.:5.00   3rd Qu.:6.00   3rd Qu.:5.00
##  Max.   :6.00   Max.   :7.00   Max.   :8.00   Max.   :8.00
##
##      Q9.av          Q10.av         Q11.av         Q12.av
##  Min.   :1.00   Min.   :4.00   Min.   :1.00   Min.   :1.00
##  1st Qu.:5.00   1st Qu.:6.75   1st Qu.:4.00   1st Qu.:3.75
##  Median :6.00   Median :7.00   Median :5.50   Median :6.00
##  Mean   :5.55   Mean   :7.04   Mean   :5.21   Mean   :5.66
##  3rd Qu.:7.00   3rd Qu.:8.00   3rd Qu.:7.00   3rd Qu.:7.25
##  Max.   :8.00   Max.   :8.00   Max.   :8.00   Max.   :8.00
##  NA's   :1
```

### 4.2 Score de Likert après

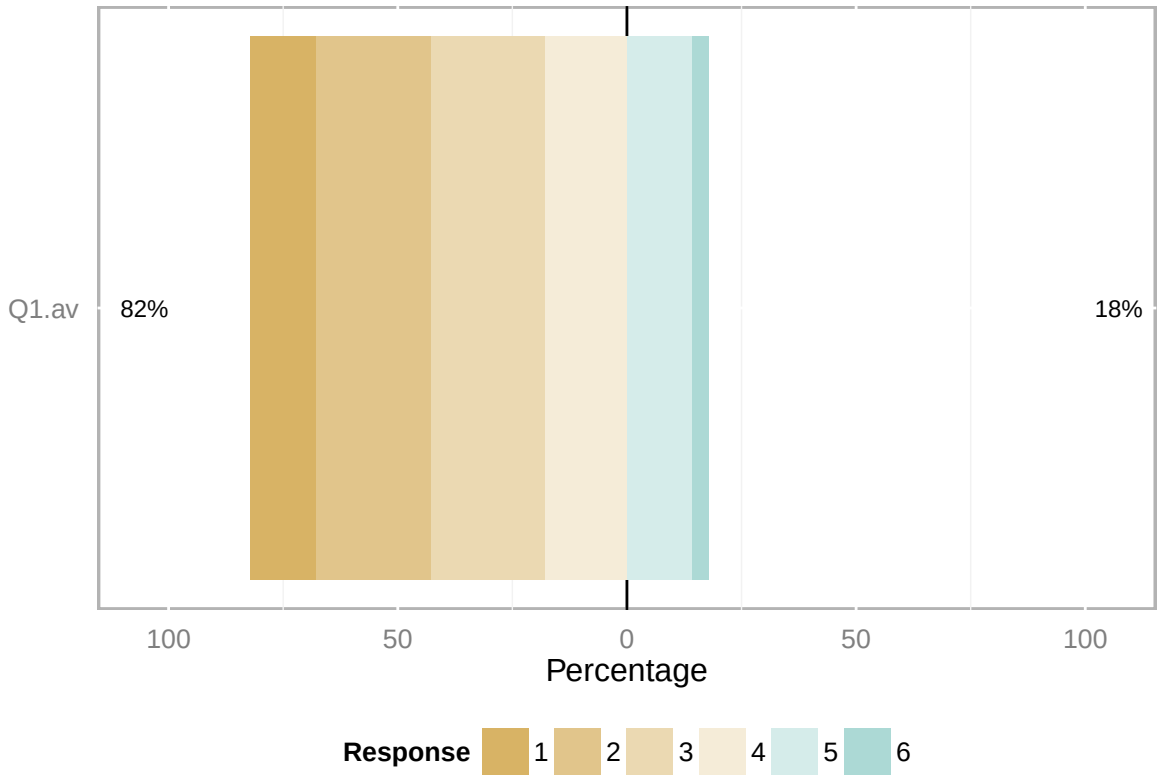
```
##      Item    1     2     3     4     5     6     7     8
## 1   Q1.ap 8.93 12.50 19.64 16.07 32.14  8.93  1.79  0.00
## 2   Q2.ap 5.36 17.86 23.21 19.64 23.21  5.36  5.36  0.00
## 3   Q3.ap 1.79  7.14  8.93 14.29 19.64 26.79 12.50  8.93
## 4   Q4.ap 1.79  1.79  3.57 17.86 14.29 26.79 23.21 10.71
## 5   Q5.ap 3.57  7.14 23.21 21.43 37.50  7.14  0.00  0.00
## 6   Q6.ap 3.57  5.36 16.07 21.43 25.00 26.79  1.79  0.00
## 7   Q7.ap 0.00  5.36  5.36 28.57 19.64 16.07 19.64  5.36
## 8   Q8.ap 3.57  5.36 14.29 19.64 32.14 16.07  7.14  1.79
## 9   Q9.ap 1.79  3.57  7.14  5.36 19.64 28.57 23.21 10.71
## 10 Q10.ap 0.00  1.79  1.79  0.00  7.14 14.29 37.50 37.50
## 11 Q11.ap 5.36 10.71 10.71  8.93 16.07 30.36 14.29  3.57
## 12 Q12.ap 1.79 10.71  8.93  5.36 17.86 23.21 16.07 16.07
```




```
##       Q1.ap           Q2.ap           Q3.ap           Q4.ap
##  Min.   :1.00   Min.   :1.00   Min.   :1.00   Min.   :1.00
##  1st Qu.:3.00   1st Qu.:3.00   1st Qu.:4.00   1st Qu.:4.75
##  Median :4.00   Median :4.00   Median :5.00   Median :6.00
##  Mean   :3.84   Mean   :3.75   Mean   :5.18   Mean   :5.68
##  3rd Qu.:5.00   3rd Qu.:5.00   3rd Qu.:6.00   3rd Qu.:7.00
##  Max.   :7.00   Max.   :7.00   Max.   :8.00   Max.   :8.00
##       Q5.ap           Q6.ap           Q7.ap           Q8.ap           Q9.ap
##  Min.   :1.00   Min.   :1.00   Min.   :2.00   Min.   :1.00   Min.   :1.0
##  1st Qu.:3.00   1st Qu.:3.75   1st Qu.:4.00   1st Qu.:4.00   1st Qu.:5.0
##  Median :4.00   Median :5.00   Median :5.00   Median :5.00   Median :6.0
##  Mean   :4.04   Mean   :4.46   Mean   :5.16   Mean   :4.57   Mean   :5.7
##  3rd Qu.:5.00   3rd Qu.:6.00   3rd Qu.:6.25   3rd Qu.:5.25   3rd Qu.:7.0
##  Max.   :6.00   Max.   :7.00   Max.   :8.00   Max.   :8.00   Max.   :8.0
##      Q10.ap          Q11.ap          Q12.ap
##  Min.   :2.00   Min.   :1.00   Min.   :1.00
##  1st Qu.:6.75   1st Qu.:3.00   1st Qu.:4.00
##  Median :7.00   Median :5.00   Median :6.00
##  Mean   :6.93   Mean   :4.86   Mean   :5.41
##  3rd Qu.:8.00   3rd Qu.:6.00   3rd Qu.:7.00
##  Max.   :8.00   Max.   :8.00   Max.   :8.00
```

Note: pour étudier une colonne seule, il faut utiliser la syntaxe suivante:

```
q1a <- lk.av[, 4, drop = FALSE]
# plot likert
plot(likert(q1a,nlevels = 8))
```




```
# summary spécifique
summary(likert(q1a,nlevels = 8))
```

```
##    Item  low neutral high mean   sd
## 1 Q1.av 82.1       0 17.9 3.04 1.39
```

```
# %
likert(q1a, nlevels = 8)
```

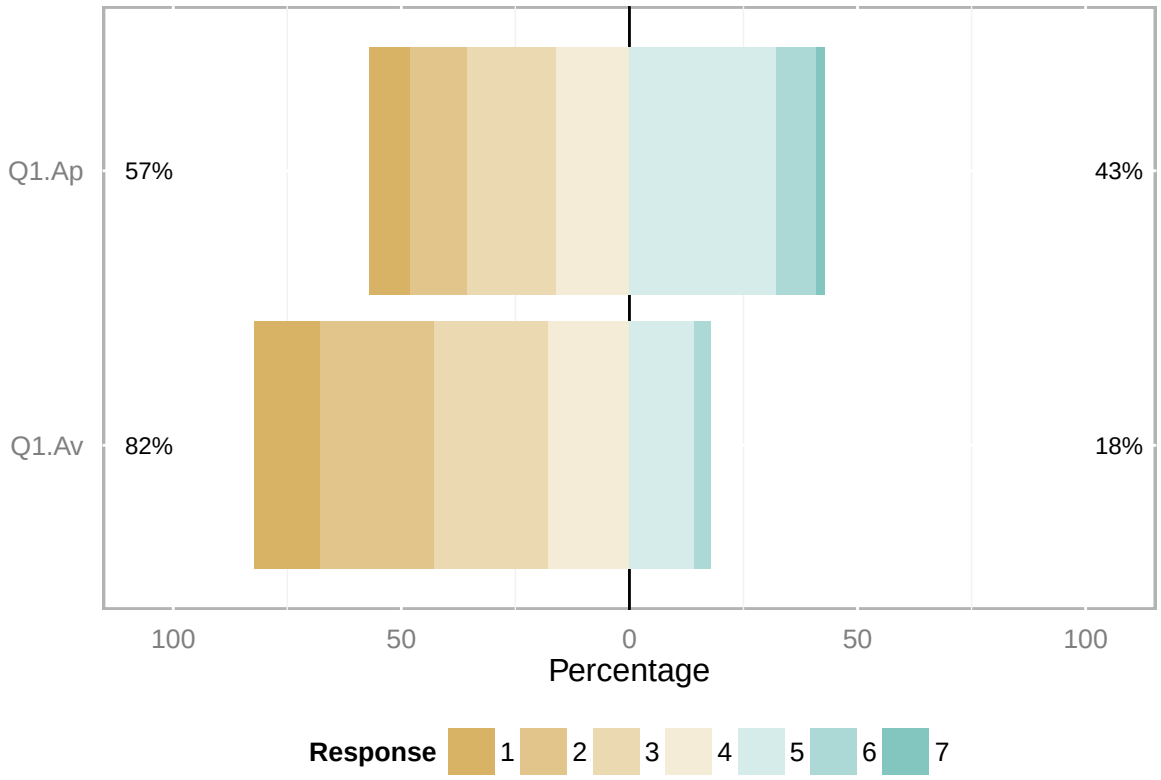
```
##    Item    1  2  3    4    5    6 7 8
## 1 Q1.av 14.3 25 25 17.9 14.3 3.57 0 0
```

```
# nombre
table(q1a)
```

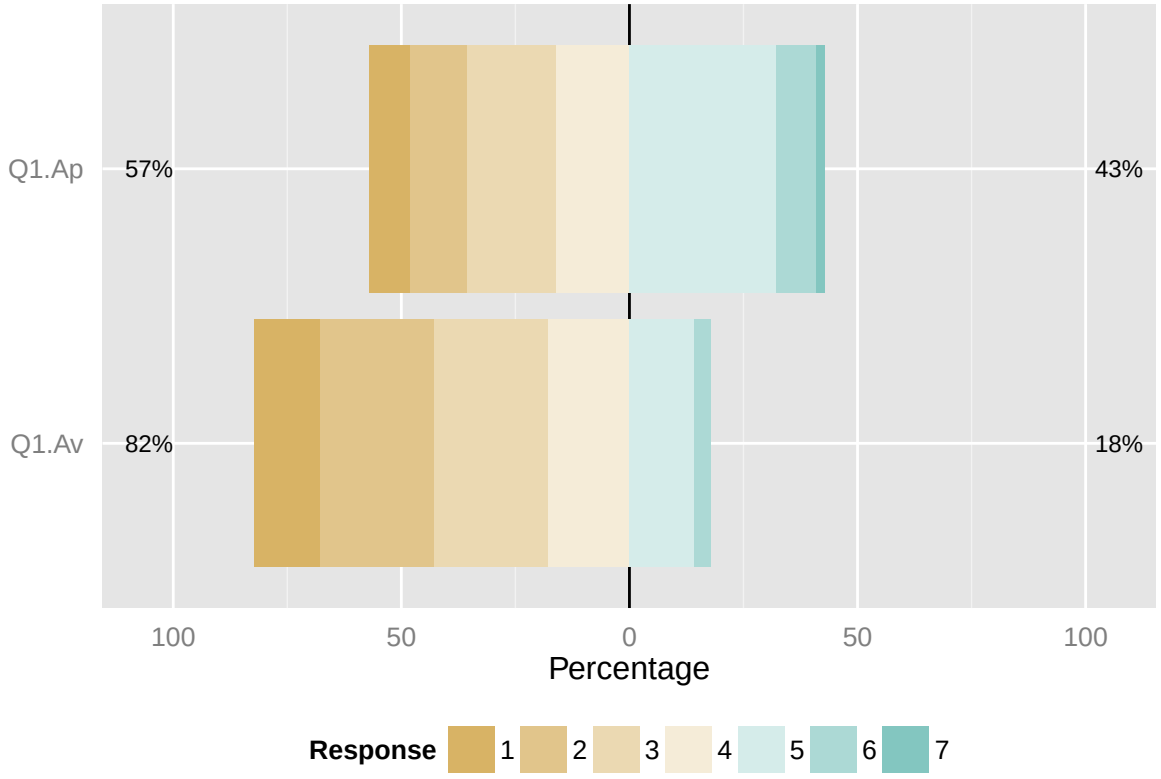
```
## q1a
##  1  2  3  4  5  6
##  8 14 14 10  8  2
```

Q1 avant et après

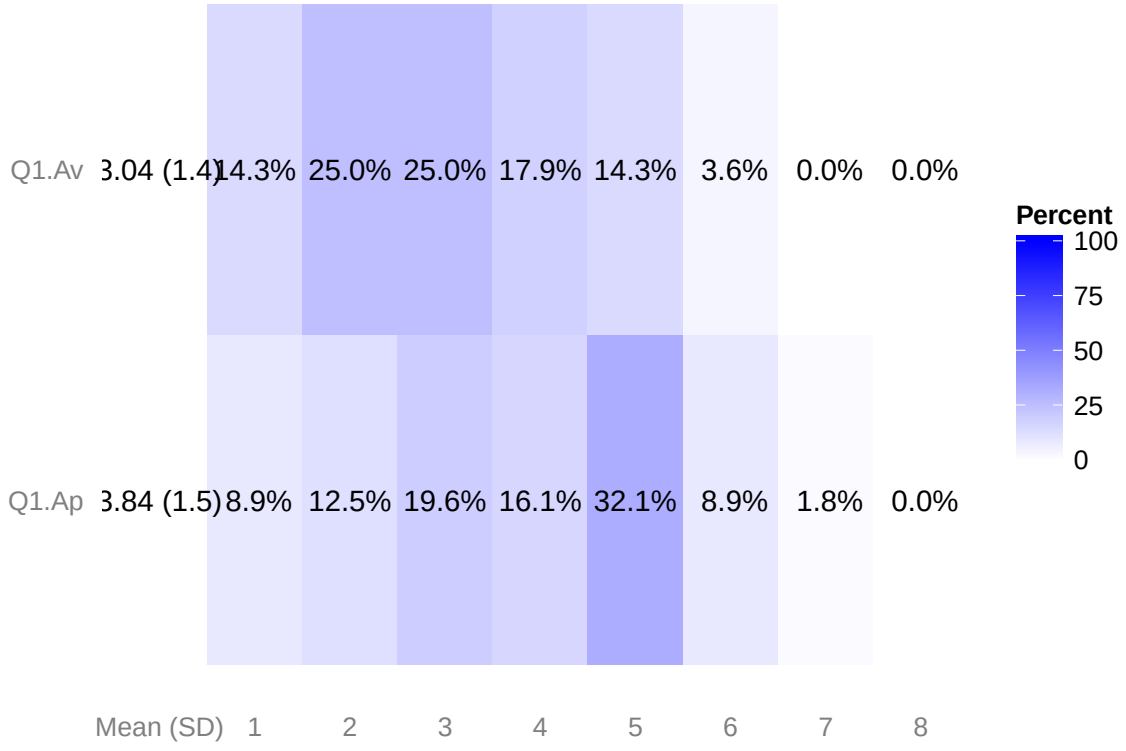
```
q1a <- lk.av[, 4, drop = FALSE]
q1p <- lk.ap[, 4, drop = FALSE]
q1 <- cbind(q1p, q1a)
names(q1) <- c("Q1.Ap","Q1.Av")
plot(likert(q1, nlevels = 8))
```



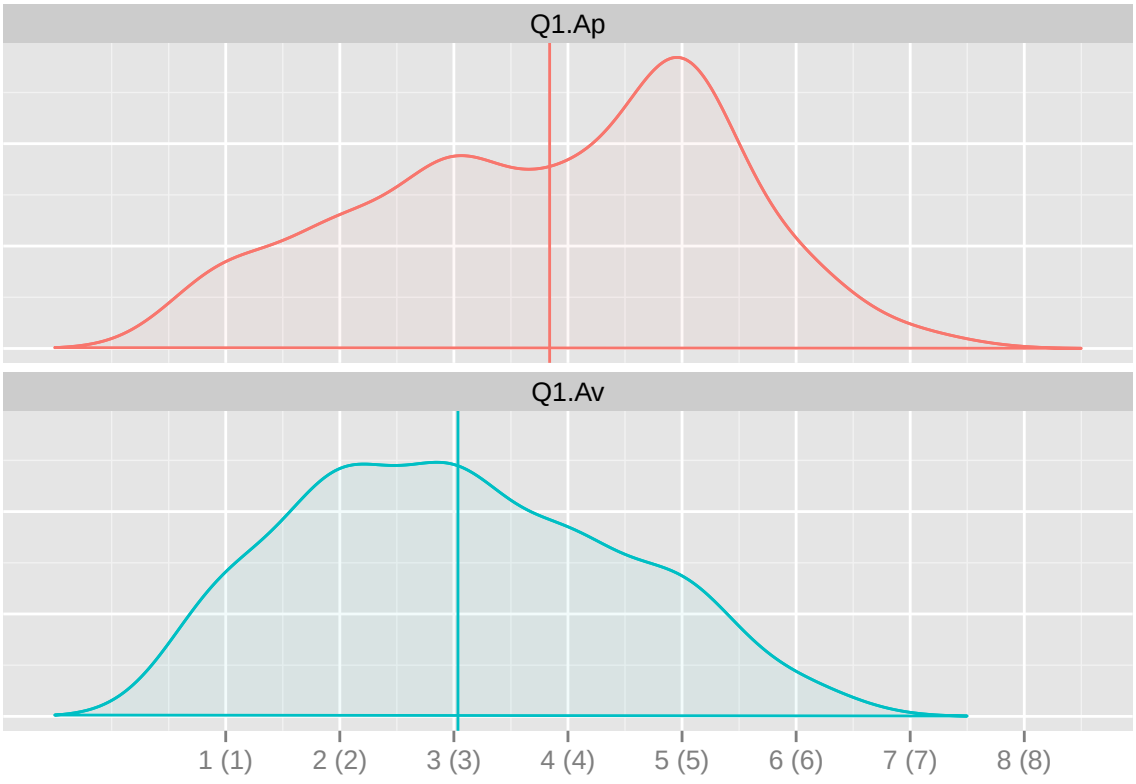

```
likert.bar.plot(likert(q1, nlevels = 8), main = "Q1")
```



```
likert.heat.plot(likert(q1, nlevels = 8), main = "Q1")
```




```
likert.density.plot(likert(q1, nlevels = 8), main = "Q1", warning = FALSE)
```



```r
summary(likert(q1, nlevels = 8))
```

```
##    Item  low neutral high mean   sd
## 1 Q1.Ap 57.1       0 42.9 3.84 1.53
## 2 Q1.Av 82.1       0 17.9 3.04 1.39
```

```r
# test du chi2 pour comparer avant-après
c <- likert(q1, nlevels = 8)
# c est un objet de type likert dont il faut extraire les données (voir str(c))
d <- c$results[,2:9]
# on regroupe les colonnes 6 et 7 pour avoir des effectifs convenables
d[,6] <-d[,6]+d[,7]
# test en éliminant le colonne 8 qui est nulle
chisq.test(d[, 1:6])
```

```
##
##  Pearson's Chi-squared test
##
## data:  d[, 1:6]
## X-squared = 16.6, df = 5, p-value = 0.005371
```

# 5 Cronbach alpha

On utilise la formule *alpha* du package *epîcalc*. Calcul du coefficient de Cronbach pour les questions avant / après et pour la totalité des 12 items et les 8 premiers:

```
Loading required package: foreign
Loading required package: survival
Loading required package: MASS
Loading required package: nnet

Attaching package: 'epicalc'

The following object is masked from 'package:likert':

    recode

Number of items in the scale = 12
Sample size = 56
Average inter-item correlation = 0.2722

Cronbach's alpha: cov/cor computed with 'pairwise.complete.obs'
      unstandardized value = 0.8008
        standardized value = 0.8178

Item(s) reversed: Q11.av, Q12.av

New alpha if item omitted:
       Reversed Alpha  Std.Alpha r(item, rest)
Q1.av      .    0.7651 0.7827    0.7032
```

```
Q2.av      .    0.7709 0.7869    0.6604
Q3.av      .    0.7709 0.7903    0.6119
Q4.av      .    0.7973 0.8138    0.3425
Q5.av      .    0.7678 0.7817    0.7109
Q6.av      .    0.7894 0.8066    0.4108
Q7.av      .    0.7733 0.7943    0.5836
Q8.av      .    0.7796 0.7985    0.5173
Q9.av      .    0.7831 0.8037    0.4848
Q10.av     .    0.809  0.8321    0.1105
Q11.av     x    0.8235 0.8359    0.0943
Q12.av     x    0.7999 0.8145    0.3691

Number of items in the scale = 8
Sample size = 56
Average inter-item correlation = 0.4226

Cronbach's alpha: cov/cor computed with 'pairwise.complete.obs'
      unstandardized value = 0.8446
        standardized value = 0.8541

Item(s) reversed:

New alpha if item omitted:
      Reversed Alpha  Std.Alpha r(item, rest)
Q1.av     .    0.8216 0.8305    0.6217
Q2.av     .    0.8148 0.8229    0.6971
Q3.av     .    0.821  0.8318    0.619
Q4.av     .    0.8503 0.8573    0.4194
Q5.av     .    0.8168 0.8243    0.6869
Q6.av     .    0.8394 0.8517    0.4763
Q7.av     .    0.8256 0.8385    0.5841
Q8.av     .    0.8199 0.8331    0.6274

Number of items in the scale = 8
Sample size = 56
Average inter-item correlation = 0.5474

Cronbach's alpha: cov/cor computed with 'pairwise.complete.obs'
      unstandardized value = 0.9043
        standardized value = 0.9063

Item(s) reversed:

New alpha if item omitted:
      Reversed Alpha  Std.Alpha r(item, rest)
Q1.ap     .    0.8863 0.8889    0.7589
Q2.ap     .    0.8854 0.8888    0.7693
Q3.ap     .    0.8886 0.8913    0.738
Q4.ap     .    0.9043 0.9065    0.5624
Q5.ap     .    0.8904 0.8906    0.7373
Q6.ap     .    0.8961 0.8982    0.6493
Q7.ap     .    0.8925 0.8953    0.6911
Q8.ap     .    0.8924 0.8943    0.6923
```

```
Number of items in the scale = 12
Sample size = 56
Average inter-item correlation = 0.2931

Cronbach's alpha: cov/cor computed with 'pairwise.complete.obs'
      unstandardized value = 0.8155
        standardized value = 0.8327

Item(s) reversed: Q12.ap

New alpha if item omitted:
       Reversed Alpha  Std.Alpha r(item, rest)
Q1.ap       .    0.7765 0.7979    0.7554
Q2.ap       .    0.7766 0.7994    0.7554
Q3.ap       .    0.7798 0.8038    0.6912
Q4.ap       .    0.7968 0.8174    0.5235
Q5.ap       .    0.7868 0.8019    0.7008
Q6.ap       .    0.7883 0.8064    0.6404
Q7.ap       .    0.7802 0.8022    0.7102
Q8.ap       .    0.7831 0.8031    0.6861
Q9.ap       .    0.8174 0.8362    0.2894
Q10.ap      .    0.8276 0.8485    0.0884
Q11.ap      .    0.8336 0.8447    0.1542
Q12.ap      x    0.8541 0.8601    -0.0462
```

La consistance interne parait bonne.

# 6 Score sur les 8 premières questions

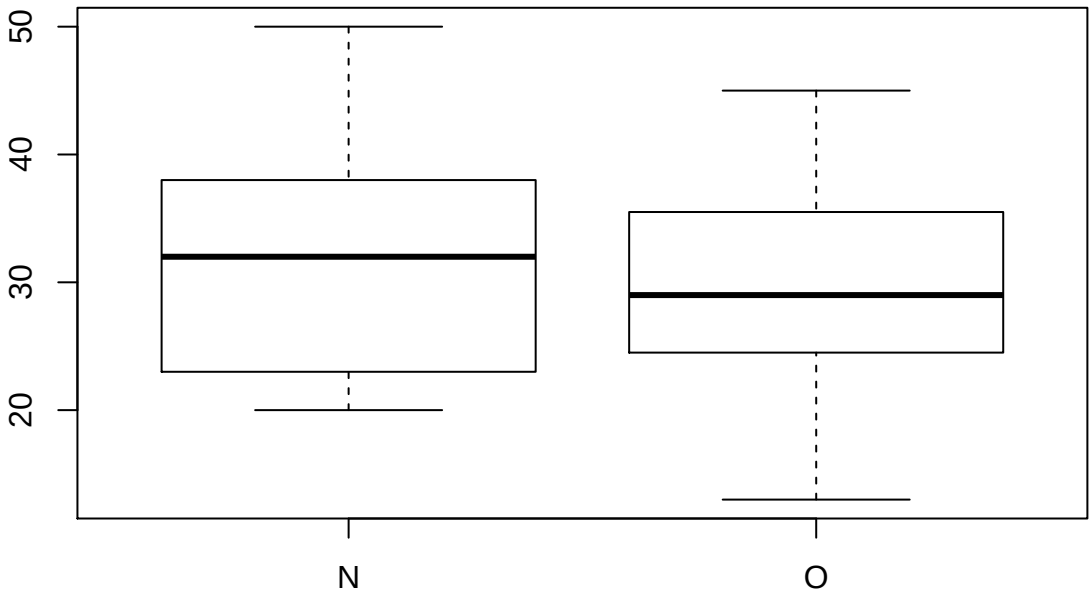
```
lkt$score.av <- apply(lkt[, c(4:11)], 1, sum, na.rm = TRUE)
lkt$score.ap <- apply(lkt[, c(16:23)], 1, sum, na.rm = TRUE)

summary(lkt$score.av)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    13.0    23.0    30.0    30.4    38.0    50.0
```

```
summary(lkt$score.ap)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    11.0    31.0    36.0    36.7    44.0    55.0
```

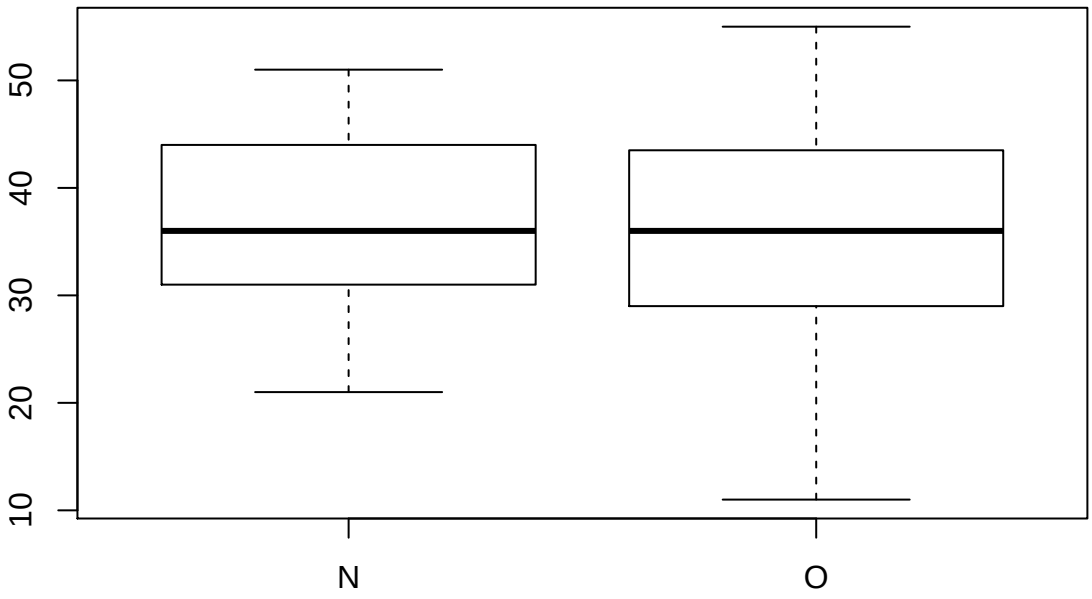
```
# création d'une colonne delta.score qui fait la différence avant/après. Onconstate que le score peut a
lkt$delta.score <- lkt$score.ap - lkt$score.av

# Comparaison des scores au et pré-briefing ou non
boxplot(score.av ~ PREB, data = lkt)
```




```r
t.test(score.av ~ PREB, data = lkt)
```

```
##
##  Welch Two Sample t-test
##
## data:  score.av by PREB
## t = 0.827, df = 52.9, p-value = 0.4119
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2.66  6.40
## sample estimates:
## mean in group N mean in group O
##            31.3            29.4
```

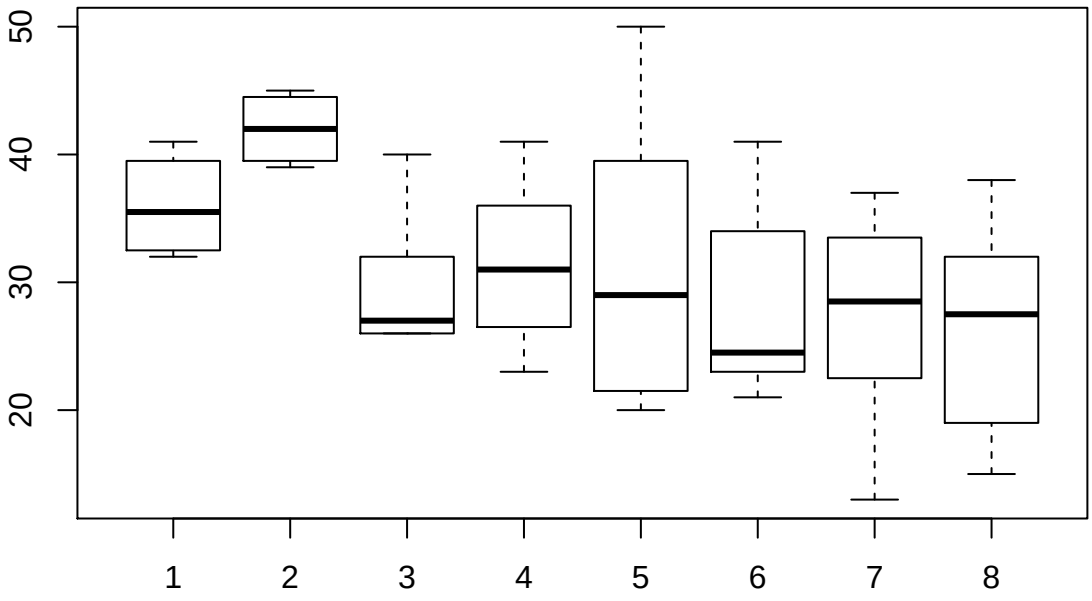
```r
# Comparaison des scores ap et pré-briefing ou non
boxplot(score.ap ~ PREB, data = lkt)
```



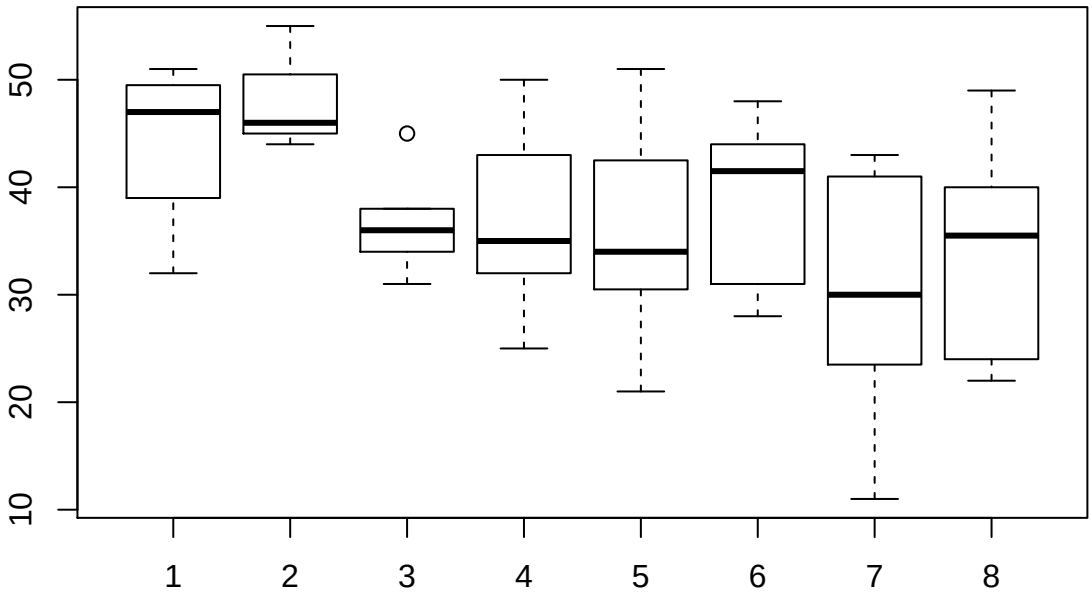

```r
t.test(score.ap ~ PREB, data = lkt)
```

```
##
##  Welch Two Sample t-test
##
## data:  score.ap by PREB
## t = 0.883, df = 50.5, p-value = 0.3816
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2.86  7.34
## sample estimates:
## mean in group N mean in group O
##            37.8            35.5
```

```r
use(lkt)

# comparaison des scores des différents groupes
boxplot(score.av ~ Groupe_ID, data = lkt)
```




```r
boxplot(score.ap ~ Groupe_ID, data = lkt)
```




```r
# l'ANOVA confirme que les groupes n'ont pas les mêmes scores
a <- aov(score.av ~ Groupe_ID, data = lkt)
summary(a)
```

```
##             Df Sum Sq Mean Sq F value  Pr(>F)
## Groupe_ID    1    762     762    13.2 0.00063 ***
## Residuals   54   3119      58
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
a2 <- aov(score.ap ~ Groupe_ID, data = lkt)
summary(a2)
```

```
##             Df Sum Sq Mean Sq F value Pr(>F)
## Groupe_ID    1    662     662    8.51 0.0051 **
## Residuals   54   4204      78
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# évolution des scores moyens par groupes
tapply(score.av, Groupe_ID, mean)
```

```
##    1    2    3    4    5    6    7    8
## 36.0 42.0 30.2 31.4 31.2 28.0 27.4 25.6
```

```r
tapply(score.ap, Groupe_ID, mean)
```

```
##    1    2    3    4    5    6    7    8
## 44.2 47.8 36.8 36.2 35.8 39.0 30.4 34.1
```

```r
# évolution des scores moyens par groupes et prebriefing
tapply(score.av, list(Groupe_ID, lkt$PREB), mean)
```

```
##      N    O
## 1 36.0   NA
## 2   NA 42.0
## 3   NA 30.2
## 4 31.4   NA
## 5 31.2   NA
## 6 28.0   NA
## 7   NA 27.4
## 8   NA 25.6
```

```r
tapply(score.ap, list(Groupe_ID, lkt$PREB), mean)
```

```
##      N    O
## 1 44.2   NA
## 2   NA 47.8
## 3   NA 36.8
## 4 36.2   NA
## 5 35.8   NA
## 6 39.0   NA
## 7   NA 30.4
## 8   NA 34.1
```