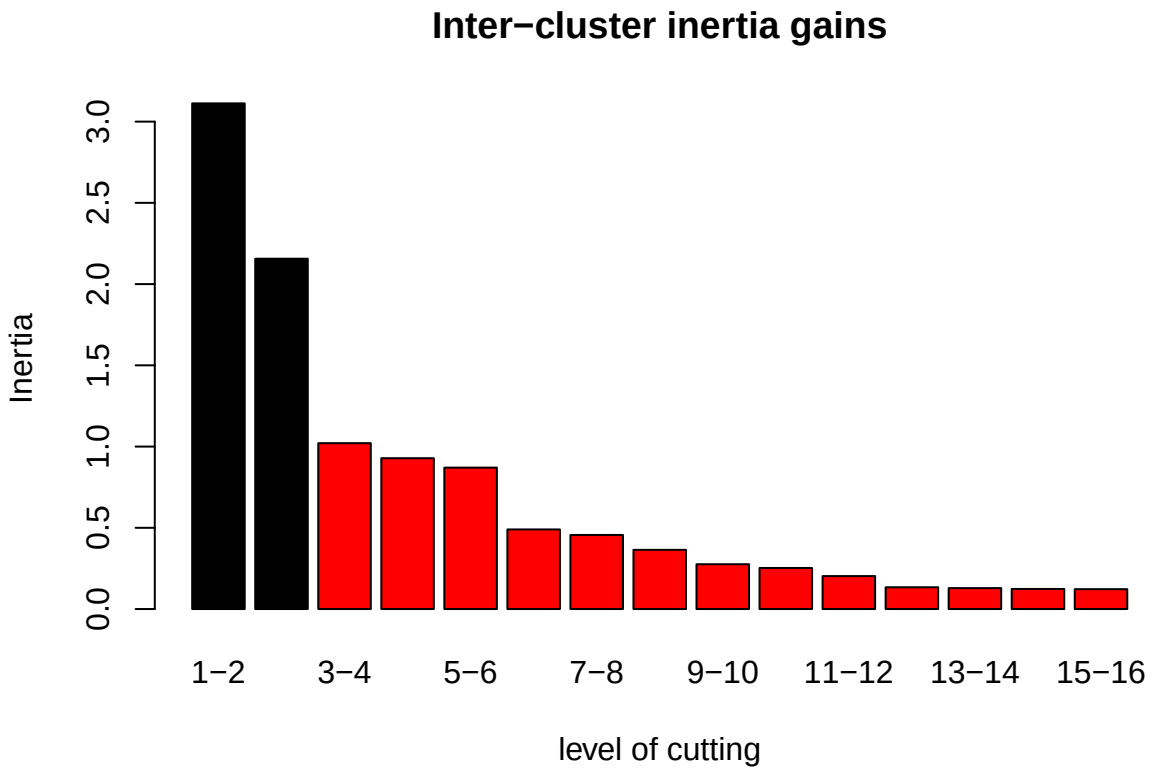
TP4

Slim Kammoun

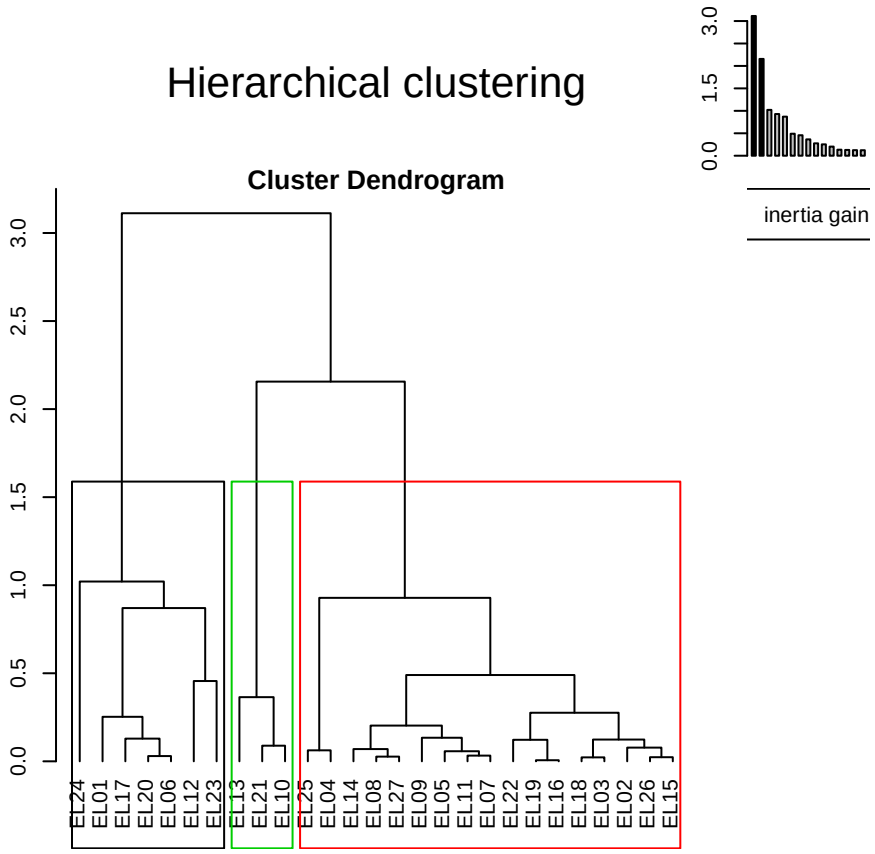
```
mydata<-read.table("Data_eleves_tp1.txt",sep="\t",dec=",",header=TRUE,fileEncoding="UTF16LE") #pb encod
rownames(mydata)=mydata$eleves
mydata=mydata[,-1]## encoding pour lire les accents
##head(mydata)
```

Avec 5 facteurs

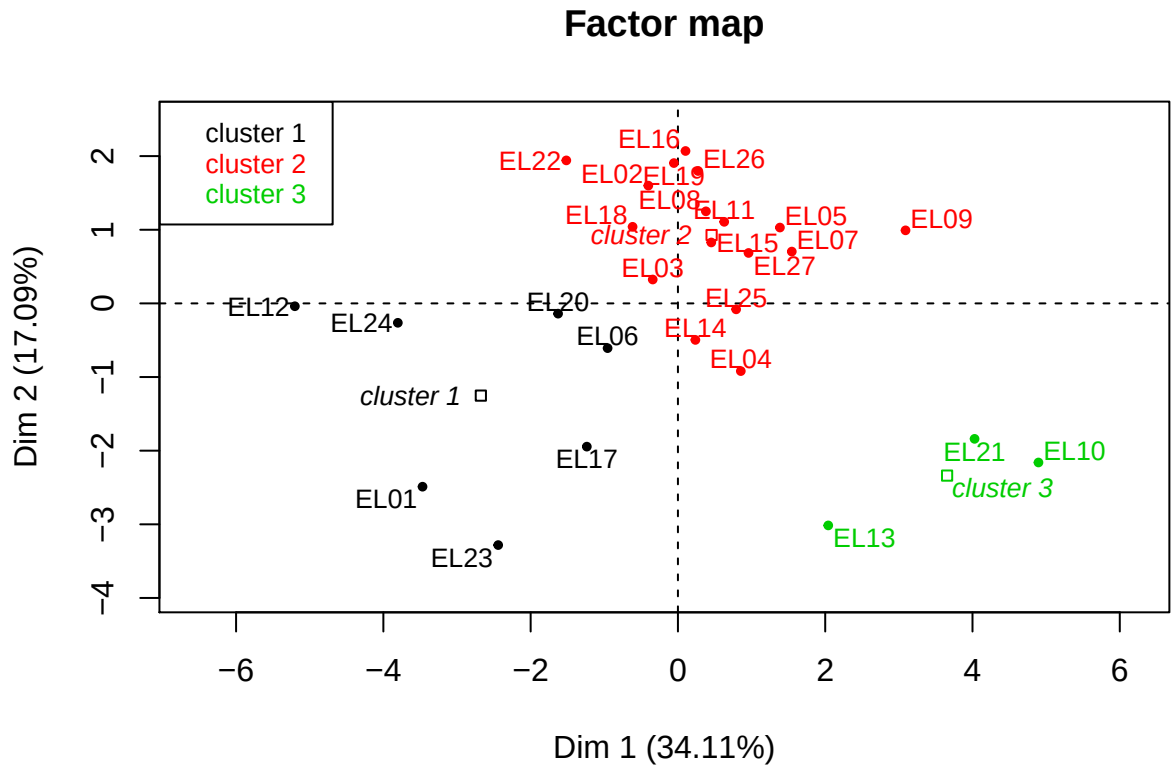
```
tab1=hcpc$call
plot(hcpc,choice="bar")
```



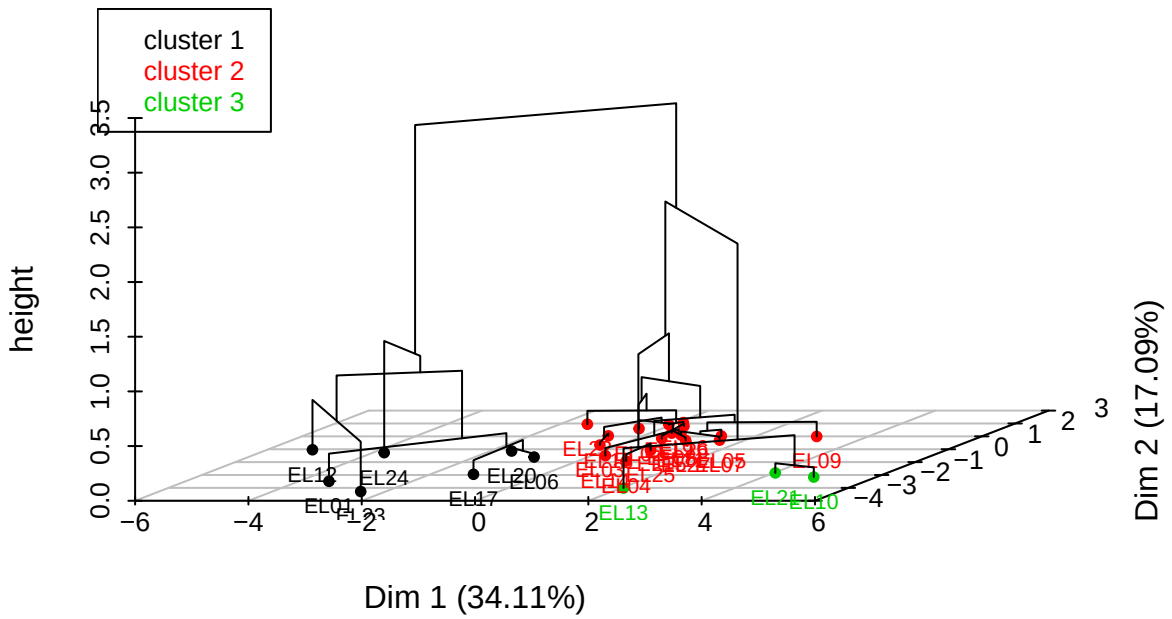

```
plot(hcpc,choice="tree")
```




```
plot(hcpc,choice="map",draw.tree = F)
```



```
plot(hcpc,choice="3D.map")
```




```
tab2=hcpc$call
```

```
hcpc$data.clust
```

```
##       ORTH GRAM EXPR RECI MATH ANGL HIST BIOL EDMU ARTS TECH  EPS   GEO
## EL01 13.0 10.0  2.0  4.0  9.0  9.0  8.0  7.0  7.5  1.5   14 10.0 10.50
## EL02  6.5  8.0  8.5 14.0 13.0  7.0 11.0  8.5 16.0  4.0   18 18.0 16.00
## EL03 14.0  6.5  8.0  5.0 11.0  8.0  9.5  8.0 18.5  9.5   14 16.5 14.00
## EL04 13.0  7.5  9.0  5.0 10.0 10.5 10.0 16.0 16.0 11.5    0 11.5 15.00
## EL05 15.0  7.5 10.0 14.0 12.0 11.0  9.0 11.0 16.5 13.5   16 13.0 15.51
## EL06  5.0  8.0  5.5  6.5 16.0 12.0  9.0  7.0 13.5  5.0   16 12.5 13.00
## EL07 12.0  6.5  9.0 16.0 18.0 13.5  9.0 10.0 15.0 11.0   16 13.5 14.00
## EL08  8.5  2.5  9.0 13.0 12.0  9.5 12.0 13.5 16.5  8.0   13 12.0 14.00
## EL09 15.5  7.5 12.5 16.0 15.0 13.0 12.0 13.5 17.0 14.0   15 16.0 15.00
## EL10 20.0 14.5 16.5 10.0 18.0 16.5 15.0 10.5 18.0 13.5   12 14.5 13.00
## EL11  6.0  4.0 11.0  9.5 13.0 12.0 11.0  7.5 17.5 12.0   18 13.5 13.00
## EL12  0.0  5.5  6.0  6.0  9.0  3.0  7.0  2.0 12.0  1.5   15 12.5 14.00
## EL13 15.5 12.0 12.0  8.0 17.0 17.0 11.0  4.5 16.0  9.0   13  5.0 12.50
## EL14 15.0  6.5 11.5 10.0 13.0 12.5  7.0 11.0 14.0  7.0   14 11.0 15.00
## EL15 11.0  9.0  7.5 11.0 12.5 11.0  9.0 11.5 18.0  8.5   17 15.0 15.00
## EL16  6.5  9.0 10.0 10.0 10.0  6.5  7.0 12.5 18.0 14.5   16 13.5 13.00
## EL17  7.0  4.5  6.0  6.0 15.0 13.5 11.0  7.0  7.0  6.5   11 10.5 13.50
## EL18 11.5  8.5  7.5 12.0 10.0  7.5  8.0 10.0 17.5  7.0   11 16.5 15.50
## EL19  4.5  7.5  9.0 12.0 12.0  9.0  7.0 11.5 17.0 12.5   12 16.0 13.00
## EL20  5.5  8.0  8.0 11.0 10.0 12.0  8.0  7.0 12.0  5.0   18 10.5 13.00
## EL21 16.0 13.5 14.5  9.5 16.0 17.0 11.5 12.5 19.0 13.5    6 11.0 16.00
## EL22  5.5  2.0  7.5 14.5 11.0 10.0  7.0  8.0 15.5  8.0   16 13.5 13.00
## EL23 14.0  8.0  6.5  6.5 10.0 14.5  9.0  5.0  9.5  3.5    0 18.5 13.00
## EL24  5.5  8.0  4.5 15.0  8.0  7.5  5.0  5.0 13.5  8.0    6  9.0  0.00
```

```
## EL25 11.0  4.0 10.5  6.0 11.0 12.0  9.0 17.0 14.0 12.5    8 10.5 17.50
## EL26  4.5  7.0 10.5 11.5 14.0  8.5  7.5  7.0 18.0 14.0   13 15.5 18.00
## EL27  9.0  8.5  7.5 10.0 14.0 11.5  9.0 15.0 17.5  9.0   13 13.5 17.50
##      EXPO clust
## EL01 13.0     1
## EL02 15.0     2
## EL03 13.0     2
## EL04 18.0     2
## EL05 17.0     2
## EL06 17.5     1
## EL07 18.0     2
## EL08 17.0     2
## EL09 17.0     2
## EL10 15.0     3
## EL11 17.0     2
## EL12  0.0     1
## EL13 16.5     3
## EL14 13.0     2
## EL15 15.0     2
## EL16 18.0     2
## EL17 16.0     1
## EL18 14.0     2
## EL19 18.0     2
## EL20 15.0     1
## EL21 16.0     3
## EL22 15.0     2
## EL23  0.0     1
## EL24 13.0     1
## EL25 15.0     2
## EL26 13.0     2
## EL27 16.0     2
```

```
hcpc$desc.ind
```

```
## $para
## Cluster: 1
##     EL01     EL20     EL06     EL17     EL12
## 1.695465 1.891662 2.460727 2.890586 3.467758
## ------------------------------------------------------------
## Cluster: 2
##      EL15      EL27      EL05      EL08      EL26
## 0.7336117 0.9432825 1.1502765 1.2387551 1.4105964
## ------------------------------------------------------------
## Cluster: 3
##     EL21     EL10     EL13
## 1.508058 1.843671 2.560873
##
## $dist
## Cluster: 1
##     EL24     EL12     EL23     EL01     EL17
## 6.549454 6.078931 6.077132 5.293463 4.213412
## ------------------------------------------------------------
## Cluster: 2
##     EL04     EL25     EL16     EL26     EL27
## 5.255808 5.040745 4.626394 4.417745 4.323927
```

```
## ----------------------------------------------------------
## Cluster: 3
##     EL10     EL13     EL21
## 5.811845 5.047106 4.633292
```

```
hcpc$desc.var
```

```
##
## Link between the cluster variable and the quantitative variables
## ================================================================
##            Eta2      P-value
## EXPR 0.71539493 2.824304e-07
## EDMU 0.70890932 3.701175e-07
## GRAM 0.53989807 9.000128e-05
## ARTS 0.51153881 1.844849e-04
## BIOL 0.43199002 1.127903e-03
## ANGL 0.40777314 1.861475e-03
## MATH 0.37029314 3.887417e-03
## ORTH 0.34994451 5.693839e-03
## HIST 0.34711756 5.998185e-03
## GEO  0.28050543 1.924555e-02
## EXPO 0.26410391 2.522307e-02
## EPS  0.22104966 4.990192e-02
## RECI 0.16932766 1.079337e-01
## TECH 0.06459432 4.487454e-01
##
## Description of each cluster by quantitative variables
## ======================================================
## $`1`
##          v.test Mean in category Overall mean sd in category Overall sd
## GRAM -0.1356952         7.428571     7.555556       1.699340   2.822966
## ANGL -0.6563349        10.214286    10.925926       3.711537   3.270813
## TECH -0.7595873        11.428571    12.629630       5.900536   4.769876
## EPS  -1.1817674        11.928571    13.074074       2.932924   2.924050
## HIST -1.5331929         8.142857     9.203704       1.726149   2.087260
## MATH -1.7176060        11.000000    12.574074       2.927700   2.764536
## ORTH -1.8344889         7.142857    10.018519       4.509627   4.728717
## RECI -1.9032830         7.857143    10.074074       3.512369   3.513739
## EXPO -2.6204369        10.642857    14.481481       6.890544   4.418986
## GEO  -2.6451029        11.000000    13.796667       4.605897   3.189472
## BIOL -3.2264077         5.714286     9.592593       1.749636   3.626132
## EXPR -3.4205919         5.500000     8.888889       1.732051   2.988662
## ARTS -3.5872961         4.428571     9.018519       2.258770   3.859768
## EDMU -4.2619279        10.714286    15.203704       2.519313   3.177640
##           p.value
## GRAM 8.920622e-01
## ANGL 5.116087e-01
## TECH 4.475013e-01
## EPS  2.372980e-01
## HIST 1.252283e-01
## MATH 8.586850e-02
## ORTH 6.658146e-02
## RECI 5.700363e-02
## EXPO 8.781717e-03
## GEO  8.166608e-03
```

```
## BIOL 1.253547e-03
## EXPR 6.248501e-04
## ARTS 3.341248e-04
## EDMU 2.026709e-05
##
## $`2`
##          v.test Mean in category Overall mean sd in category Overall sd
## BIOL  3.0657251        11.264706     9.592593       2.926138   3.626132
## EDMU  2.9582747        16.617647    15.203704       1.334270   3.177640
## GEO   2.3869041        14.941765    13.796667       1.570920   3.189472
## ARTS  2.3491548        10.382353     9.018519       2.943235   3.859768
## EPS   2.2389896        14.058824    13.074074       2.078478   2.924050
## RECI  2.0301827        11.147059    10.074074       3.328861   3.513739
## EXPO  2.0190941        15.823529    14.481481       1.790015   4.418986
## TECH  1.2541268        13.529412    12.629630       4.216461   4.769876
## EXPR  0.9668622         9.323529     8.888889       1.484639   2.988662
## ORTH -0.1087385         9.941176    10.018519       3.741195   4.728717
## MATH -0.3195994        12.441176    12.574074       1.999135   2.764536
## HIST -0.4614701         9.058824     9.203704       1.652826   2.087260
## ANGL -1.5233553        10.176471    10.925926       2.092994   3.270813
## GRAM -2.2781158         6.588235     7.555556       2.109051   2.822966
##          p.value
## BIOL 0.002171428
## EDMU 0.003093663
## GEO  0.016990921
## ARTS 0.018816082
## EPS  0.025156590
## RECI 0.042337968
## EXPO 0.043477439
## TECH 0.209795936
## EXPR 0.333612915
## ORTH 0.913409883
## MATH 0.749272015
## HIST 0.644461334
## ANGL 0.127669850
## GRAM 0.022719676
##
## $`3`
##           v.test Mean in category Overall mean sd in category Overall sd
## GRAM  3.68974966        13.333333     7.555556      1.0274023   2.822966
## EXPR  3.28411603        14.333333     8.888889      1.8408935   2.988662
## ANGL  3.25598884        16.833333    10.925926      0.2357023   3.270813
## MATH  2.88618070        17.000000    12.574074      0.8164966   2.764536
## HIST  2.84702605        12.500000     9.203704      1.7795130   2.087260
## ORTH  2.72515912        17.166667    10.018519      2.0138410   4.728717
## EDMU  1.39731692        17.666667    15.203704      1.2472191   3.177640
## ARTS  1.39255594        12.000000     9.018519      2.1213203   3.859768
## EXPO  0.55150338        15.833333    14.481481      0.6236096   4.418986
## GEO   0.02072499        13.833333    13.796667      1.5456031   3.189472
## BIOL -0.21175425         9.166667     9.592593      3.3993463   3.626132
## RECI -0.46555870         9.166667    10.074074      0.8498366   3.513739
## TECH -0.86788571        10.333333    12.629630      3.0912062   4.769876
## EPS  -1.79251490        10.166667    13.074074      3.9228674   2.924050
##           p.value
```

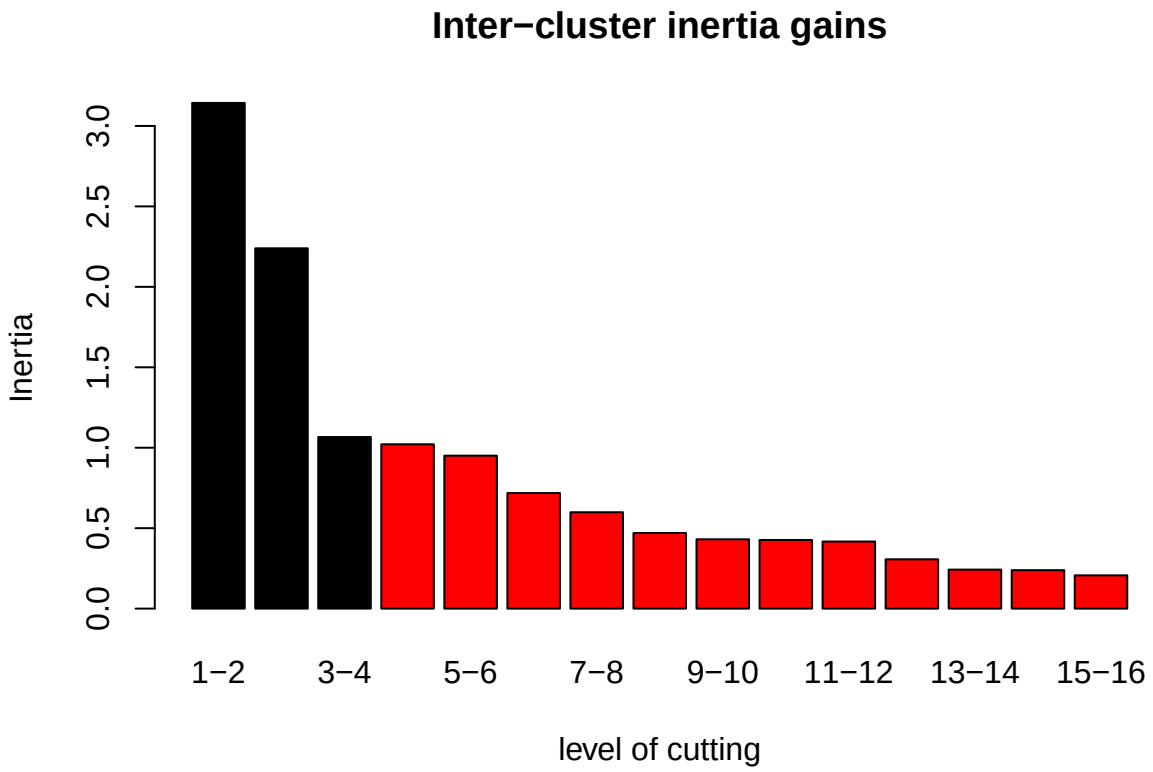
```
## GRAM 0.0002244748
## EXPR 0.0010230279
## ANGL 0.0011299819
## MATH 0.0038994820
## HIST 0.0044129752
## ORTH 0.0064270504
## EDMU 0.1623182909
## ARTS 0.1637541137
## EXPO 0.5812886471
## GEO  0.9834650360
## BIOL 0.8322987625
## RECI 0.6415314109
## TECH 0.3854569006
## EPS  0.0730505250
```

```
pl1=fviz_cluster(hcpc, ellipse=F)
```

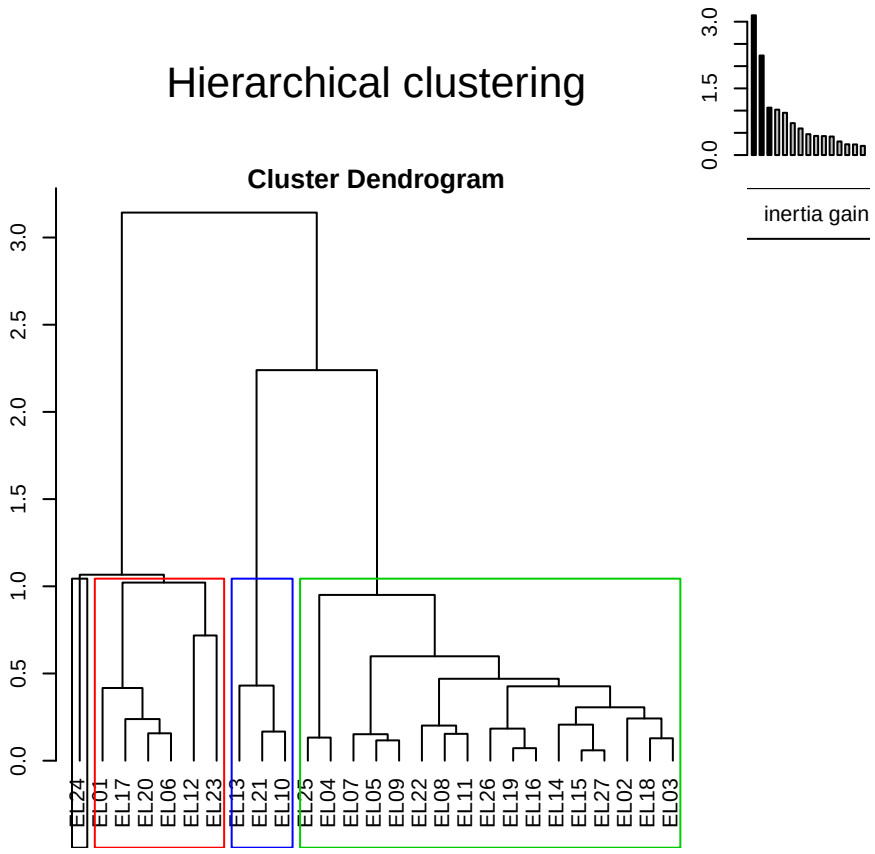
```
mydata1<-cbind(mydata,hcpc$call$X[,6][match(rownames(mydata), rownames(hcpc$call$X))])

colnames(mydata1)<-c(colnames(mydata),"Classe")
```

avec 14 facteurs

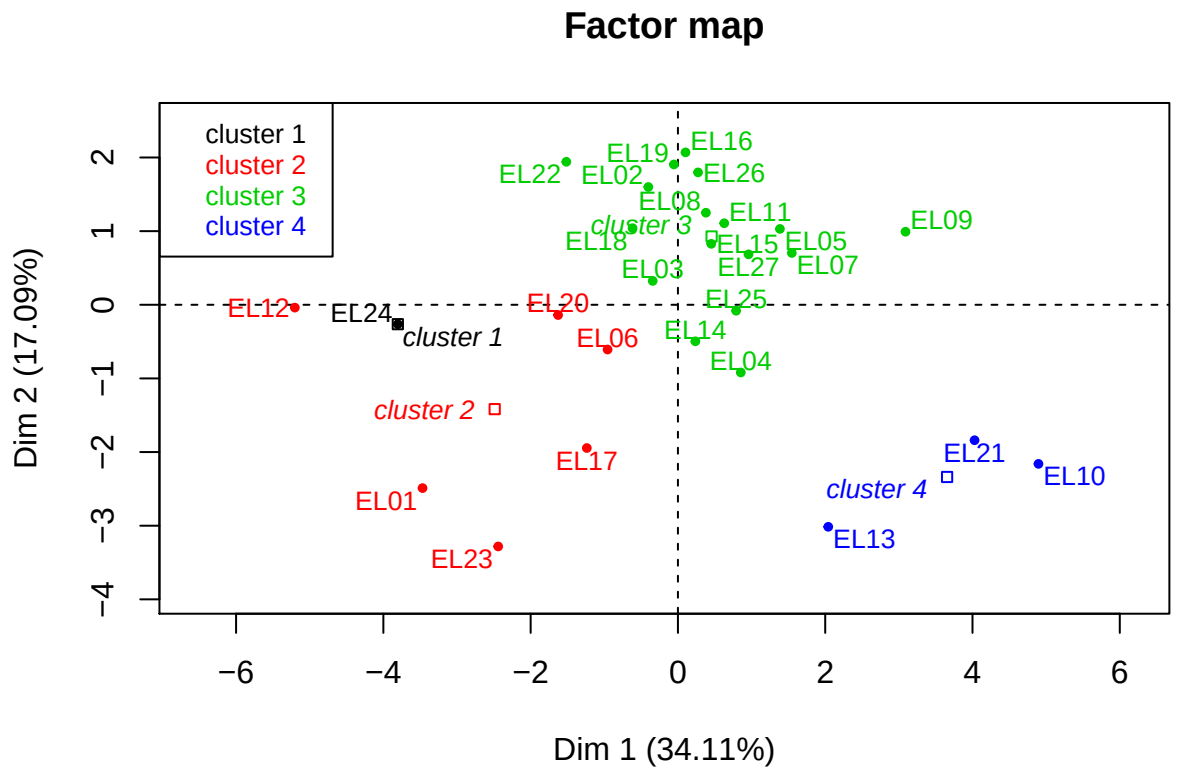
```
tab1=hcpc$call
plot(hcpc,choice="bar")
```



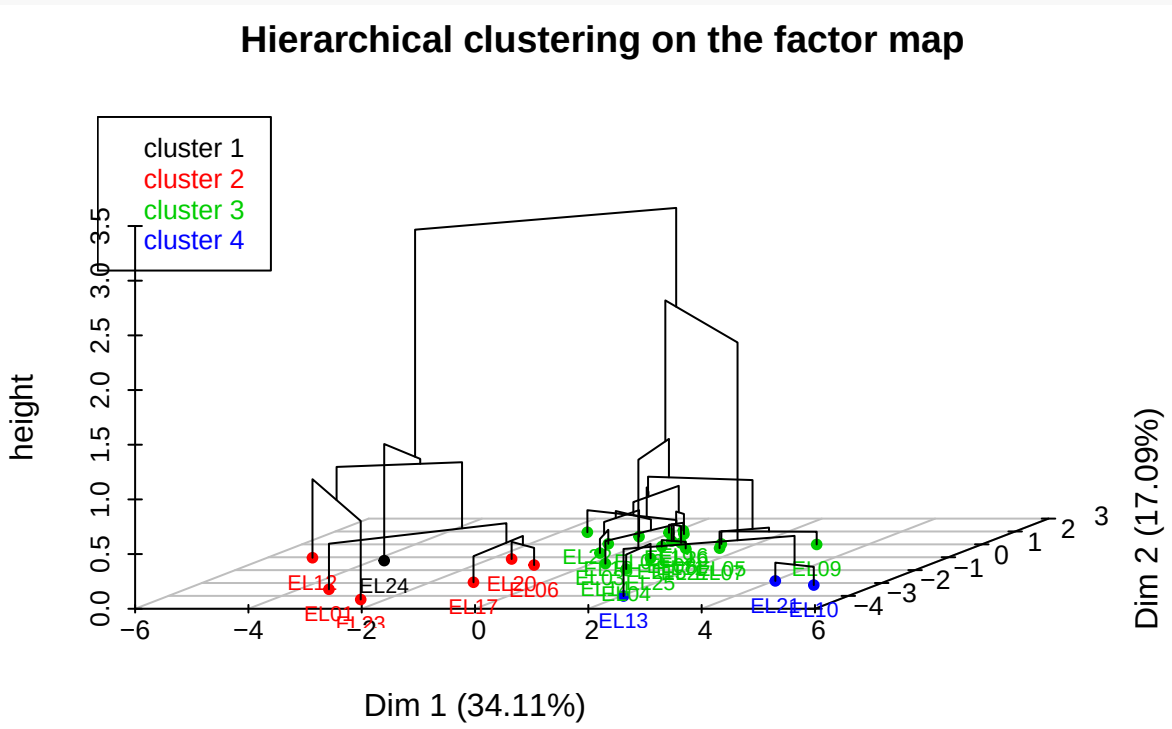

```
plot(hcpc,choice="tree")
```




```
plot(hcpc,choice="map",draw.tree = F)
```



```
plot(hcpc,choice="3D.map")
```




```
tab2=hcpc$call
```

```
hcpc$data.clust
```

```
##       ORTH GRAM EXPR RECI MATH ANGL HIST BIOL EDMU ARTS TECH  EPS   GEO
## EL01 13.0 10.0  2.0  4.0  9.0  9.0  8.0  7.0  7.5  1.5   14 10.0 10.50
## EL02  6.5  8.0  8.5 14.0 13.0  7.0 11.0  8.5 16.0  4.0   18 18.0 16.00
## EL03 14.0  6.5  8.0  5.0 11.0  8.0  9.5  8.0 18.5  9.5   14 16.5 14.00
## EL04 13.0  7.5  9.0  5.0 10.0 10.5 10.0 16.0 16.0 11.5    0 11.5 15.00
## EL05 15.0  7.5 10.0 14.0 12.0 11.0  9.0 11.0 16.5 13.5   16 13.0 15.51
## EL06  5.0  8.0  5.5  6.5 16.0 12.0  9.0  7.0 13.5  5.0   16 12.5 13.00
## EL07 12.0  6.5  9.0 16.0 18.0 13.5  9.0 10.0 15.0 11.0   16 13.5 14.00
## EL08  8.5  2.5  9.0 13.0 12.0  9.5 12.0 13.5 16.5  8.0   13 12.0 14.00
## EL09 15.5  7.5 12.5 16.0 15.0 13.0 12.0 13.5 17.0 14.0   15 16.0 15.00
## EL10 20.0 14.5 16.5 10.0 18.0 16.5 15.0 10.5 18.0 13.5   12 14.5 13.00
## EL11  6.0  4.0 11.0  9.5 13.0 12.0 11.0  7.5 17.5 12.0   18 13.5 13.00
## EL12  0.0  5.5  6.0  6.0  9.0  3.0  7.0  2.0 12.0  1.5   15 12.5 14.00
## EL13 15.5 12.0 12.0  8.0 17.0 17.0 11.0  4.5 16.0  9.0   13  5.0 12.50
## EL14 15.0  6.5 11.5 10.0 13.0 12.5  7.0 11.0 14.0  7.0   14 11.0 15.00
## EL15 11.0  9.0  7.5 11.0 12.5 11.0  9.0 11.5 18.0  8.5   17 15.0 15.00
## EL16  6.5  9.0 10.0 10.0 10.0  6.5  7.0 12.5 18.0 14.5   16 13.5 13.00
## EL17  7.0  4.5  6.0  6.0 15.0 13.5 11.0  7.0  7.0  6.5   11 10.5 13.50
## EL18 11.5  8.5  7.5 12.0 10.0  7.5  8.0 10.0 17.5  7.0   11 16.5 15.50
## EL19  4.5  7.5  9.0 12.0 12.0  9.0  7.0 11.5 17.0 12.5   12 16.0 13.00
## EL20  5.5  8.0  8.0 11.0 10.0 12.0  8.0  7.0 12.0  5.0   18 10.5 13.00
## EL21 16.0 13.5 14.5  9.5 16.0 17.0 11.5 12.5 19.0 13.5    6 11.0 16.00
## EL22  5.5  2.0  7.5 14.5 11.0 10.0  7.0  8.0 15.5  8.0   16 13.5 13.00
## EL23 14.0  8.0  6.5  6.5 10.0 14.5  9.0  5.0  9.5  3.5    0 18.5 13.00
## EL24  5.5  8.0  4.5 15.0  8.0  7.5  5.0  5.0 13.5  8.0    6  9.0  0.00
```

```
## EL25 11.0  4.0 10.5  6.0 11.0 12.0  9.0 17.0 14.0 12.5    8 10.5 17.50
## EL26  4.5  7.0 10.5 11.5 14.0  8.5  7.5  7.0 18.0 14.0   13 15.5 18.00
## EL27  9.0  8.5  7.5 10.0 14.0 11.5  9.0 15.0 17.5  9.0   13 13.5 17.50
##      EXPO clust
## EL01 13.0     2
## EL02 15.0     3
## EL03 13.0     3
## EL04 18.0     3
## EL05 17.0     3
## EL06 17.5     2
## EL07 18.0     3
## EL08 17.0     3
## EL09 17.0     3
## EL10 15.0     4
## EL11 17.0     3
## EL12  0.0     2
## EL13 16.5     4
## EL14 13.0     3
## EL15 15.0     3
## EL16 18.0     3
## EL17 16.0     2
## EL18 14.0     3
## EL19 18.0     3
## EL20 15.0     2
## EL21 16.0     4
## EL22 15.0     3
## EL23  0.0     2
## EL24 13.0     1
## EL25 15.0     3
## EL26 13.0     3
## EL27 16.0     3
```

```
hcpc$desc.ind
```

```
## $para
## Cluster: 1
##  EL24
##     0
## ------------------------------------------------------------
## Cluster: 2
##     EL20     EL06     EL01     EL17     EL12
## 2.531889 2.773215 2.914207 2.921985 4.182515
## ------------------------------------------------------------
## Cluster: 3
##     EL15     EL05     EL27     EL19     EL18
## 1.522523 1.791672 1.849280 2.025643 2.202491
## ------------------------------------------------------------
## Cluster: 4
##     EL21     EL10     EL13
## 1.726560 2.325256 2.784566
##
## $dist
## Cluster: 1
##     EL24
## 5.795936
```

```
## ----------------------------------------------------------
## Cluster: 2
##     EL12     EL23     EL01     EL17     EL06
## 6.520057 6.393968 5.757894 4.538136 3.471892
## ----------------------------------------------------------
## Cluster: 3
##     EL04     EL16     EL25     EL26     EL08
## 5.382701 5.168707 5.031229 4.858357 4.711478
## ----------------------------------------------------------
## Cluster: 4
##     EL10     EL13     EL21
## 5.962563 5.335127 4.823028
```

```
hcpc$desc.var
```

```
##
## Link between the cluster variable and the quantitative variables
## ================================================================
##           Eta2      P-value
## GEO  0.7944671 4.458321e-08
## EDMU 0.7421176 5.875901e-07
## EXPR 0.7202325 1.479369e-06
## ARTS 0.5485339 3.221334e-04
## GRAM 0.5416686 3.811058e-04
## HIST 0.4450845 3.159979e-03
## ANGL 0.4375297 3.665175e-03
## BIOL 0.4336667 3.950598e-03
## MATH 0.4211771 5.015329e-03
## ORTH 0.3551600 1.618963e-02
## RECI 0.3478892 1.826402e-02
## EXPO 0.2763984 5.515801e-02
## EPS  0.2643933 6.551873e-02
## TECH 0.1205623 3.889685e-01
##
## Description of each cluster by quantitative variables
## =====================================================
## $`1`
##          v.test Mean in category Overall mean sd in category Overall sd
## RECI  1.4019042             15.0    10.074074              0   3.513739
## GRAM  0.1574388              8.0     7.555556              0   2.822966
## ARTS -0.2638808              8.0     9.018519              0   3.859768
## EXPO -0.3352537             13.0    14.481481              0   4.418986
## EDMU -0.5361538             13.5    15.203704              0   3.177640
## ORTH -0.9555484              5.5    10.018519              0   4.728717
## ANGL -1.0474234              7.5    10.925926              0   3.270813
## BIOL -1.2665266              5.0     9.592593              0   3.626132
## TECH -1.3898957              6.0    12.629630              0   4.769876
## EPS  -1.3932983              9.0    13.074074              0   2.924050
## EXPR -1.4685131              4.5     8.888889              0   2.988662
## MATH -1.6545538              8.0    12.574074              0   2.764536
## HIST -2.0139821              5.0     9.203704              0   2.087260
## GEO  -4.3256895              0.0    13.796667              0   3.189472
##           p.value
## RECI 1.609439e-01
## GRAM 8.748990e-01
```

```
## ARTS 7.918718e-01
## EXPO 7.374337e-01
## EDMU 5.918522e-01
## ORTH 3.393004e-01
## ANGL 2.949043e-01
## BIOL 2.053246e-01
## TECH 1.645606e-01
## EPS  1.635296e-01
## EXPR 1.419649e-01
## MATH 9.801504e-02
## HIST 4.401141e-02
## GEO  1.520555e-05
##
## $`2`
##          v.test Mean in category Overall mean sd in category Overall sd
## TECH -0.1693058        12.333333    12.629630       5.906682   4.769876
## GRAM -0.2145530         7.333333     7.555556       1.818119   2.822966
## ANGL -0.2160385        10.666667    10.925926       3.826080   3.270813
## EPS  -0.6127770        12.416667    13.074074       2.892759   2.924050
## HIST -0.7012622         8.666667     9.203704       1.247219   2.087260
## GEO  -0.8232096        12.833333    13.796667       1.105542   3.189472
## MATH -1.0589235        11.500000    12.574074       2.872281   2.764536
## ORTH -1.4996567         7.416667    10.018519       4.816782   4.728717
## EXPO -2.6098918        10.250000    14.481481       7.369701   4.418986
## RECI -2.6430608         6.666667    10.074074       2.114763   3.513739
## BIOL -2.8256041         5.833333     9.592593       1.863390   3.626132
## EXPR -2.9385385         5.666667     8.888889       1.818119   2.988662
## ARTS -3.6614725         3.833333     9.018519       1.863390   3.859768
## EDMU -4.2489149        10.250000    15.203704       2.428134   3.177640
##           p.value
## TECH 8.655561e-01
## GRAM 8.301159e-01
## ANGL 8.289577e-01
## EPS  5.400238e-01
## HIST 4.831394e-01
## GEO  4.103888e-01
## MATH 2.896346e-01
## ORTH 1.337033e-01
## EXPO 9.057087e-03
## RECI 8.216027e-03
## BIOL 4.719155e-03
## EXPR 3.297637e-03
## ARTS 2.507698e-04
## EDMU 2.148085e-05
##
## $`3`
##          v.test Mean in category Overall mean sd in category Overall sd
## BIOL  3.0657251        11.264706     9.592593       2.926138   3.626132
## EDMU  2.9582747        16.617647    15.203704       1.334270   3.177640
## GEO   2.3869041        14.941765    13.796667       1.570920   3.189472
## ARTS  2.3491548        10.382353     9.018519       2.943235   3.859768
## EPS   2.2389896        14.058824    13.074074       2.078478   2.924050
## RECI  2.0301827        11.147059    10.074074       3.328861   3.513739
## EXPO  2.0190941        15.823529    14.481481       1.790015   4.418986
```

```
## TECH  1.2541268        13.529412    12.629630       4.216461   4.769876
## EXPR  0.9668622         9.323529     8.888889       1.484639   2.988662
## ORTH -0.1087385         9.941176    10.018519       3.741195   4.728717
## MATH -0.3195994        12.441176    12.574074       1.999135   2.764536
## HIST -0.4614701         9.058824     9.203704       1.652826   2.087260
## ANGL -1.5233553        10.176471    10.925926       2.092994   3.270813
## GRAM -2.2781158         6.588235     7.555556       2.109051   2.822966
##          p.value
## BIOL 0.002171428
## EDMU 0.003093663
## GEO  0.016990921
## ARTS 0.018816082
## EPS  0.025156590
## RECI 0.042337968
## EXPO 0.043477439
## TECH 0.209795936
## EXPR 0.333612915
## ORTH 0.913409883
## MATH 0.749272015
## HIST 0.644461334
## ANGL 0.127669850
## GRAM 0.022719676
##
## $`4`
##           v.test Mean in category Overall mean sd in category Overall sd
## GRAM  3.68974966        13.333333     7.555556      1.0274023   2.822966
## EXPR  3.28411603        14.333333     8.888889      1.8408935   2.988662
## ANGL  3.25598884        16.833333    10.925926      0.2357023   3.270813
## MATH  2.88618070        17.000000    12.574074      0.8164966   2.764536
## HIST  2.84702605        12.500000     9.203704      1.7795130   2.087260
## ORTH  2.72515912        17.166667    10.018519      2.0138410   4.728717
## EDMU  1.39731692        17.666667    15.203704      1.2472191   3.177640
## ARTS  1.39255594        12.000000     9.018519      2.1213203   3.859768
## EXPO  0.55150338        15.833333    14.481481      0.6236096   4.418986
## GEO   0.02072499        13.833333    13.796667      1.5456031   3.189472
## BIOL -0.21175425         9.166667     9.592593      3.3993463   3.626132
## RECI -0.46555870         9.166667    10.074074      0.8498366   3.513739
## TECH -0.86788571        10.333333    12.629630      3.0912062   4.769876
## EPS  -1.79251490        10.166667    13.074074      3.9228674   2.924050
##           p.value
## GRAM 0.0002244748
## EXPR 0.0010230279
## ANGL 0.0011299819
## MATH 0.0038994820
## HIST 0.0044129752
## ORTH 0.0064270504
## EDMU 0.1623182909
## ARTS 0.1637541137
## EXPO 0.5812886471
## GEO  0.9834650360
## BIOL 0.8322987625
## RECI 0.6415314109
## TECH 0.3854569006
## EPS  0.0730505250
```